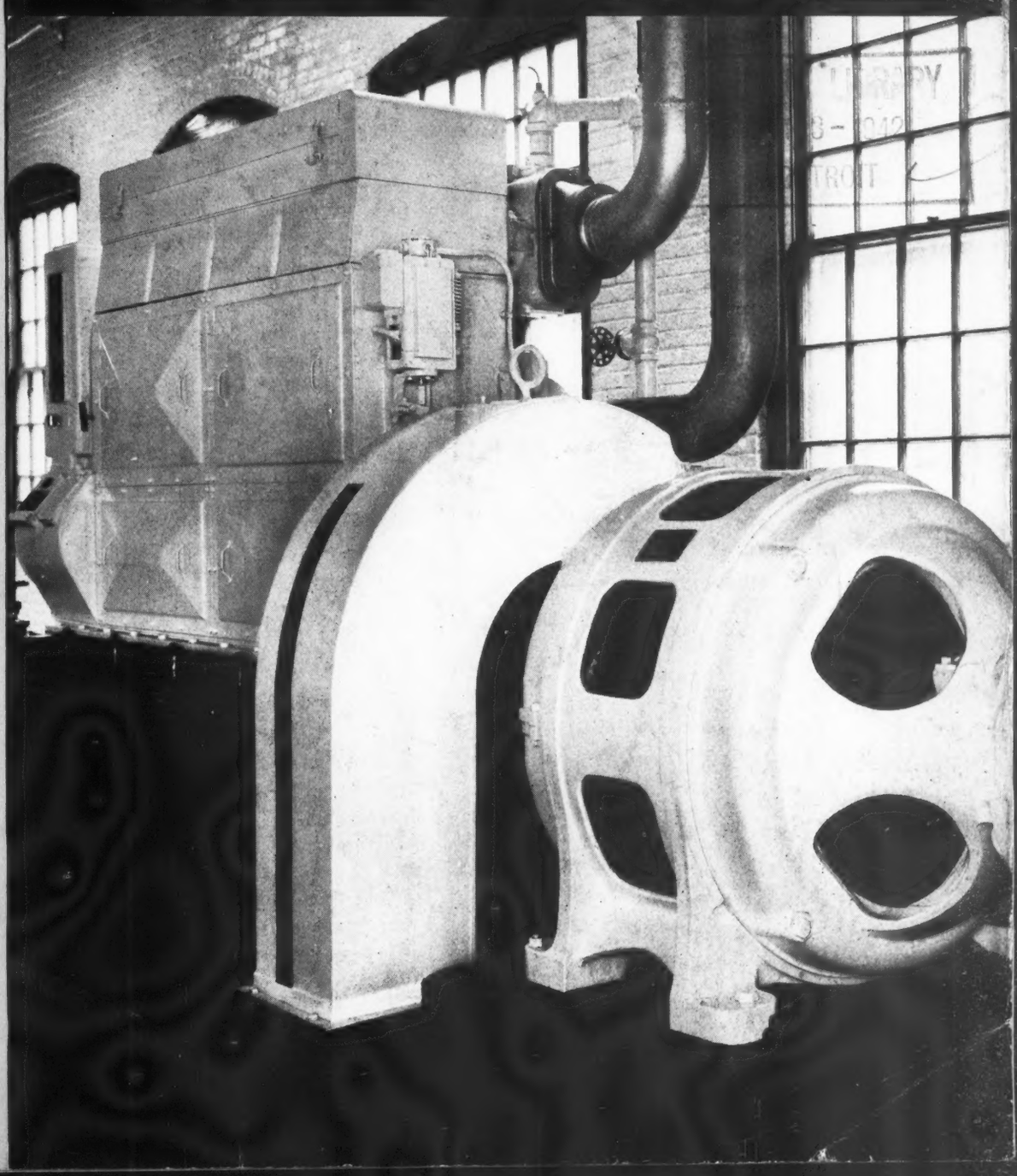
...NOLOGY DEPT.

POWER

POWER GENERATION, TRANSMISSION, APPLICATION AND THE ATTENDANT SERVICES IN ALL INDUSTRIES



JUNE, 1942

...w to get the most out of die-...s and gas engines. Fourth ...artime special section starts ... page 99

...er 200 practical suggestions for ...aking vital mechanical rubber ...ods wear better and last ...nger. Page 64

...artime Conservation — ways to ...ake now-scarce manila rope ...ve longer life, (page 79); to ...new worn parts by gas weld-...g, (page 84); to make weld-...g oxygen go farther, (page ...); build replacement roller ...earings, (page 110)

...res for emergency problems. ...eas and suggestions from ...wer engineers. Wartime Pow-... Clinic, page 91

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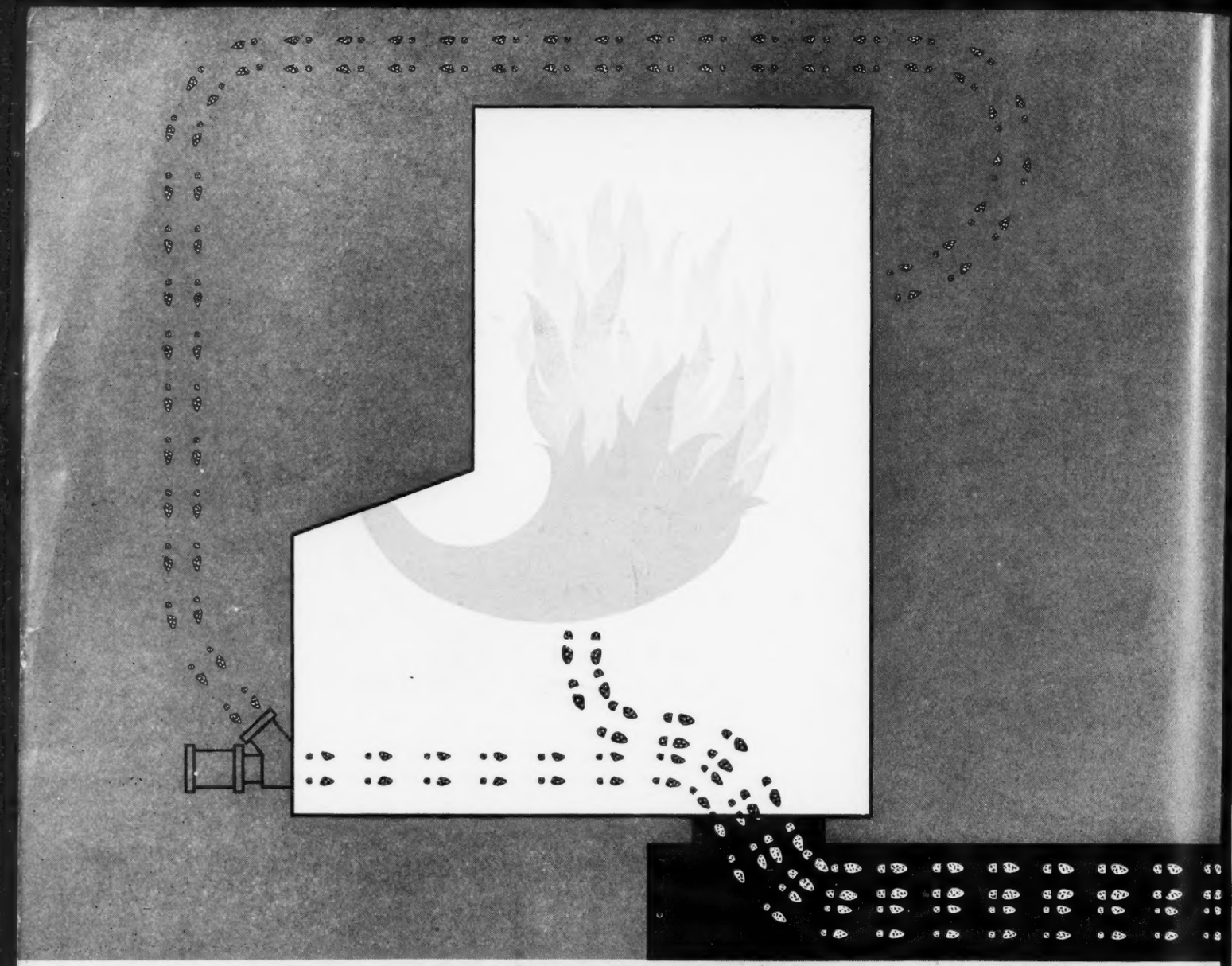
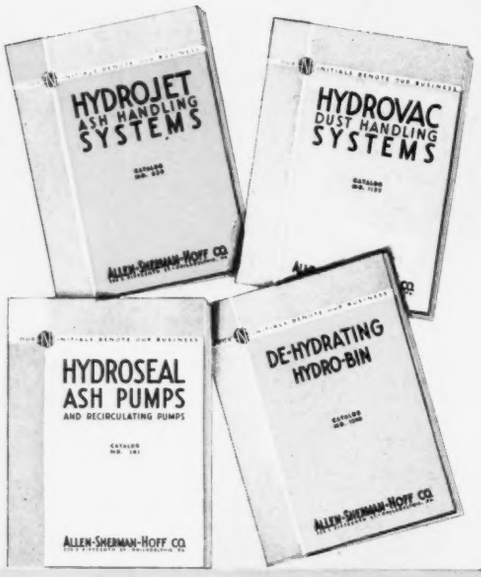


The Wedding March of FLIGHTY DUST



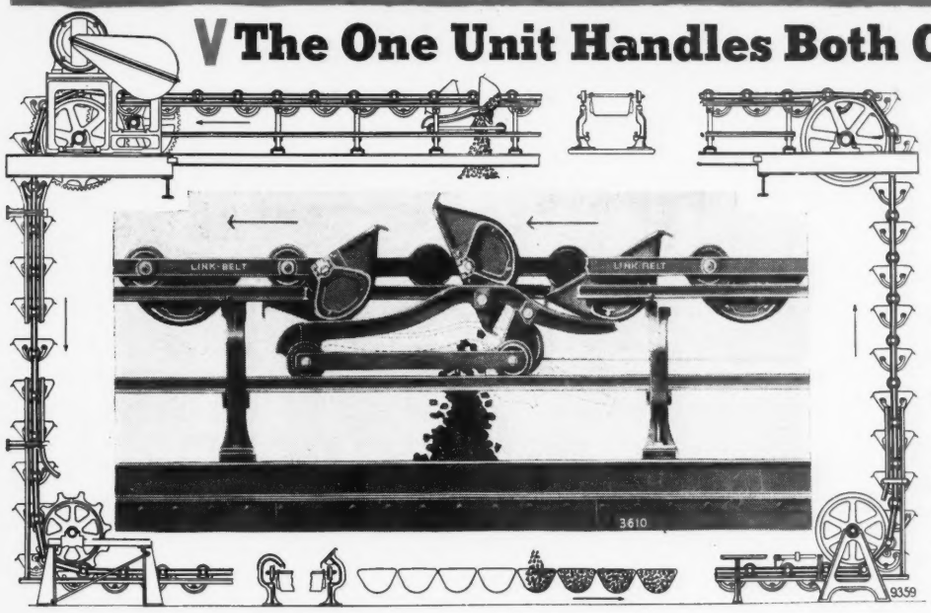
Dust collected in hoppers beneath the stack, precipitators, economizer and preheater can be returned to a wet bottom furnace by means of a Hydrovac System and an A-S-H Dust Ram. The furnace heat melts the dust, forever joining it with the ash. The problem of dust removal from the plant is eliminated, for there is no dust. All refuse is removed by the Hydrojet Ash Handling System, via sluiceways beneath the floor, to a sump from which it may be pumped, by a Hydroseal Ash Pump, through a pipe line, either to distant lowlands for fill, or pumped to a Hydro Bin, later to be dropped into trucks or railroad cars.

ALLEN-SHERMAN-HOFF CO., 227 S. 15th St., PHILADELPHIA • Offices & Representatives in Principal Cities

POWER (with which are consolidated "Science and Industry," "The Engineer Review," "The Engineer," and "The Stationary Engineer"), June, 1942, Vol. 86, No. 6. Published monthly with an additional Directory number in December. McGraw-Hill Publishing Company, Inc. Publication office, 99-129 North Broadway, Albany, N. Y. Editorial and Executive offices, 330 West 42nd Street, New York, N. Y. Entered as second class matter August 25, 1936, at Post Office, at Albany, N. Y., under the act of March 3, 1879. Printed in U. S. A. Allow at least ten days for change of address. All communications about subscriptions should be addressed to the Director of Circulation, 330 West 42nd Street, New York, N. Y. Subscription rates—U. S. and U. S. Possessions, $3.00 for one year, $4.00 for two years. Canada, $3.50 for one year, $5.00 for two years. Great Britain and British Possessions 36 shillings per year. All other countries $6.00 for one year, $9.00 for two years, 35c per copy.

Make Vital Savings for Victory with the PECK BUCKET CARRIER

V The One Unit Handles Both Coal and Ashes



V Conserves Steel and Other Critical Materials

V Standardized Design Permits Quicker Delivery

V Saves Power

V Saves Space

V Lowest Operating Cost

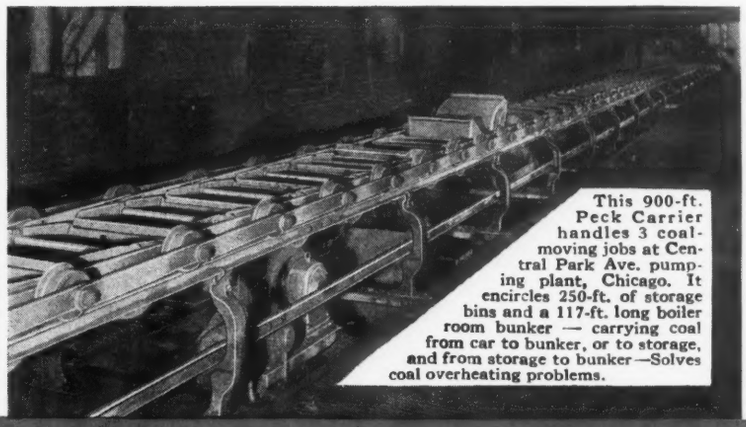
V Long Life

● Operating costs of the Peck Carrier are the lowest of any conveying machine or combination of units adaptable to similar service. Many have been in use for 30 years or more, giving low-cost performance.

The one carrier-unit elevates and conveys in a continuous flow, without transfer points—vertically, horizontally, on an incline, over any path of travel in a single vertical plane. There may be one or several loading points; and the discharge, which is positive and complete, may be concentrated or distributed. Paths of travel can be arranged to suit.

The buckets are always maintained in a horizontal position except when discharging—all without resorting to auxiliary devices or complicated mechanisms. The carrier line is strong, long-wearing, corrosion resisting and able to handle materials at high temperature. Buckets are made of malleable iron—the only use of rolled steel being in the pins and bushings for the chain. Standardization assures interchangeability of parts. Made in 11 standard bucket sizes, with coal capacities (50 lbs. per cu. ft.) from 15 to 255 tons per hour.

67 years' experience in the application of mechanical handling equipment (38 years on Peck Carriers), is available quickly through Link-Belt's nation-wide engineering service. Each application is considered as an individual problem. Each receives the personal attention of specialists.



This 900-ft. Peck Carrier handles 3 coal-moving jobs at Central Park Ave. pumping plant, Chicago. It encircles 250-ft. of storage bins and a 117-ft. long boiler room bunker — carrying coal from car to bunker, or to storage, and from storage to bunker—Solves coal overheating problems.

Send for special Engineering Catalog No. 1720 which illustrates design and performance features and gives other valuable information.

●

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8834

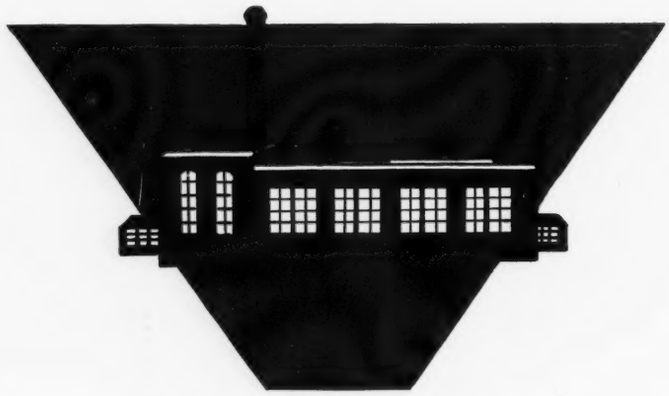
LINK-BELT

. . . Coal And Ashes Handling Equipment

CONVEYORS • ELEVATORS • SKIP HOISTS • CRUSHERS • LARRIES • SCREENS

Over 100 Babcock & Wilcox Integral-Furnace Boilers Classes 9, 12, & 15

HAVE BEEN PURCHASED

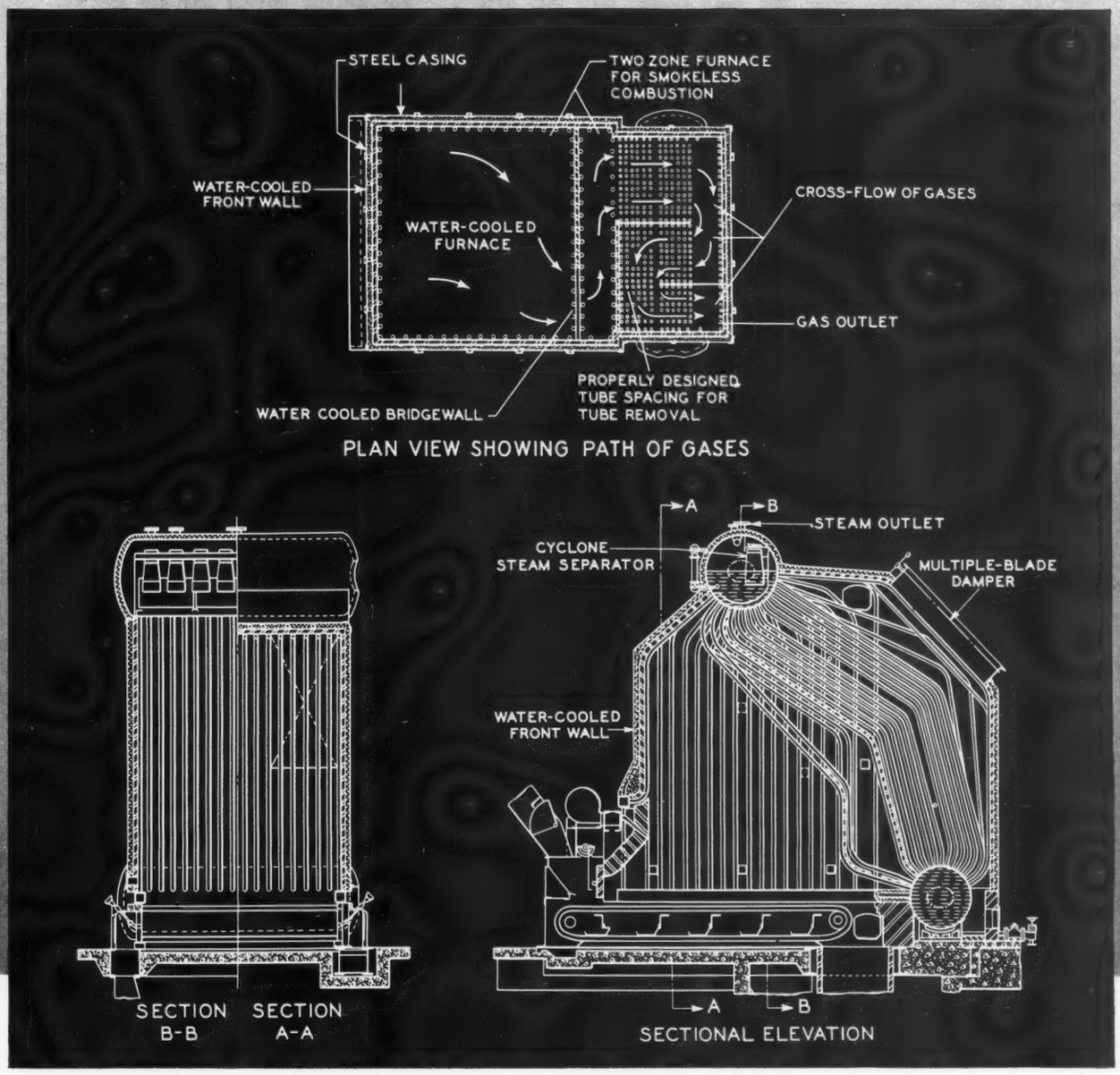


Many of the principles that have made Babcock & Wilcox Boilers the choice of so many central stations are equally effective in the smaller industrial plants in Integral-Furnace Boilers, Classes 9, 12, and 15. The fuel savings, dependability, and lessened maintenance made possible by these boilers in industrial service constitute major advantages.

● *Wide range in fuel selection.* The large amount of water-cooled surface in the furnace permits wide variation in the grades of coal that can be burned successfully. Oil-fired boilers can be readily converted to stoker firing at small cost for brick-work changes.

● *Efficient heat absorption* results from the cross flow of gases over an arrangement of heating surfaces that has demonstrated its merit in hundreds of boilers now in service. The furnace design permits operation with low excess air (high CO_2), resulting in further increase in efficiency.

● *Reduced maintenance* due to completely water-cooled furnace. The furnace contains a minimum of unprotected brickwork. Even the upper front wall and roof are water cooled, as well as the bridge wall and side walls.



● *Circulation*, always a factor in holding down boiler maintenance, is increased by the delivery of steam-free water to the downcomers by the use of B&W Cyclone Steam Separators.

● *Effective soot blowing*. The arrangement of the boiler tubes, with straight lanes between the rows, permits effective cleaning of the entire boiler by two soot-blower elements.

● *Tube removal* is simplified by proper design of tube spacing.

● *Superheaters* can be readily installed at minimum expense, even in boilers originally supplied to produce dry saturated steam only.

THE
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COMPANY
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85 LIBERTY ST., NEW YORK, N. Y.
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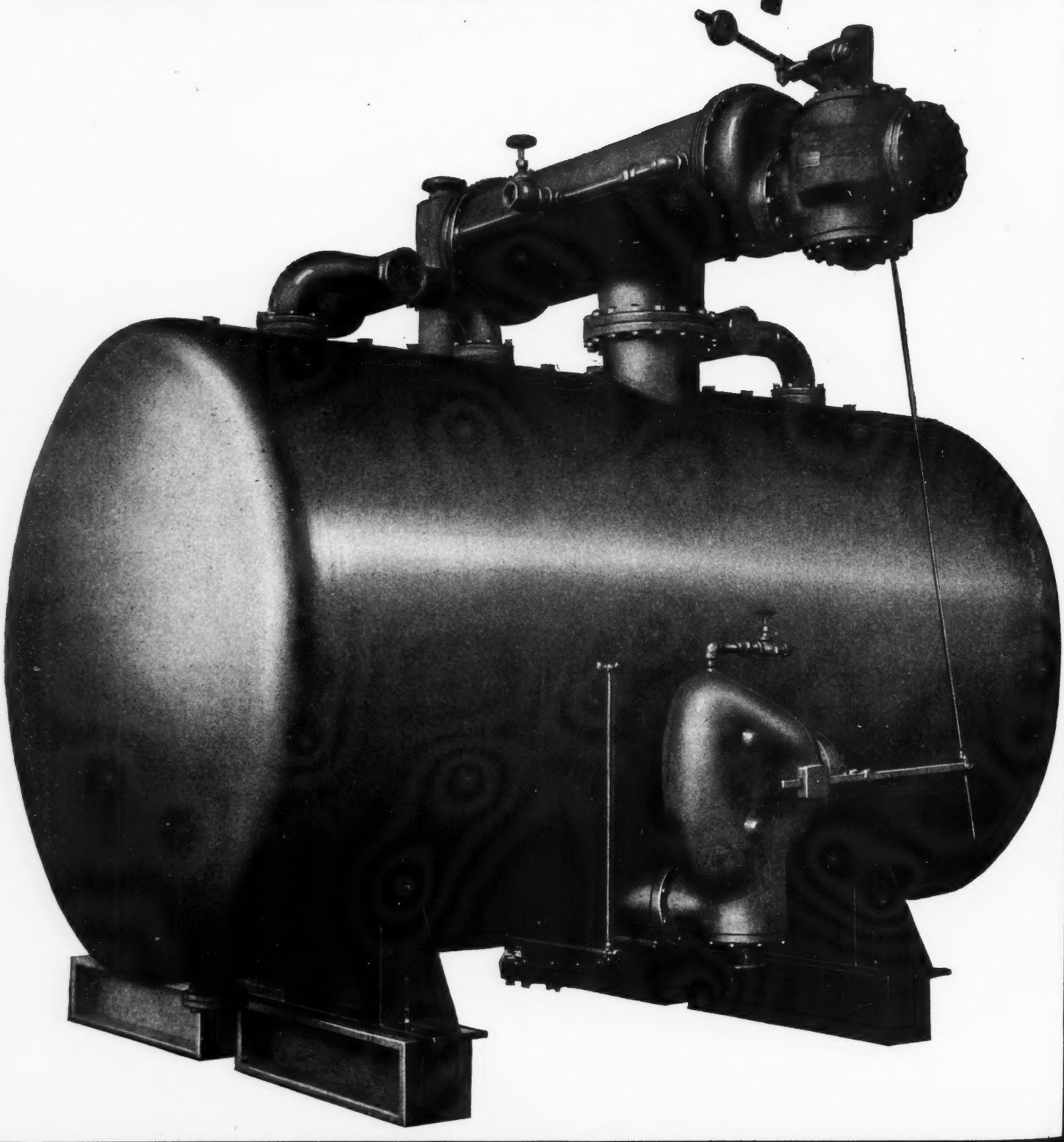
On Guard *against*



ELLIOTT COMPANY

Deaerator and Heater Department
JEANNETTE, PA.
District Offices in Principal Cities

t Nature's Sabotage!

ELLIOTT
DEAERATING HEATERS

in scores of ordnance plants are removing from boiler feedwater the corrosive element, oxygen. It is a notable fact that in spite of the speed with which these plants have been constructed, in spite of the need for elimination of all but absolutely essential equipment, Elliott deaerating heaters have been used in every one of the many plants of this type built by one of the best known organizations in the country.

Oxygen in feedwater can be as insidiously destructive as any "fifth columnist" or enemy agent, in the steam plants behind America's war production. Elliott deaerating heaters, like armed guards at the gates, prevent the intrusion of trouble-causing oxygen, delivering oxygen-free feedwater, which is also heated to the saturated temperature of the steam supplied. They thus prevent trouble while serving most efficiently as a heater.

It pays in every case to install Elliott *deaerating* heaters. They are designed and built to meet the conditions under which they operate in the individual plant.

N-966

Y *Equipment on the war path:*

TURBINE-GENERATORS • MECHANICAL DRIVE TURBINES • ENGINES
ENGINE-GENERATORS • MOTOR-GENERATORS • MOTORS
GENERATORS • CONDENSERS • STEAM JET EJECTORS
DEAERATORS • FEED-WATER HEATERS • DEAERATING HEATERS
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SEPARATORS • GREASE EXTRACTORS • NON-RETURN VALVES • LAGONDA-LIBERTY TUBE CLEANERS

DESLAGGING EQUIPMENT

A Practical Necessity

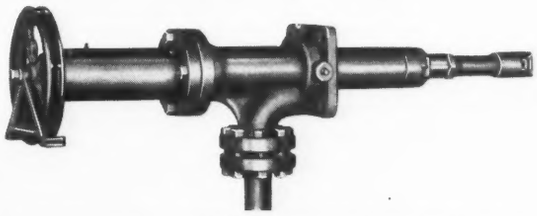
WHERE SLAG ACCUMULATIONS OCCUR

DIAMOND "TELESCOPIC" RETRACTING BLOWER

By reason of its projection of 15 feet or more, this Blower may be installed and operated for most effective slag removal in difficult and extremely hot locations. The Diamond Telescopic Blower is regularly and successfully cleaning slag which was impossible by other means.

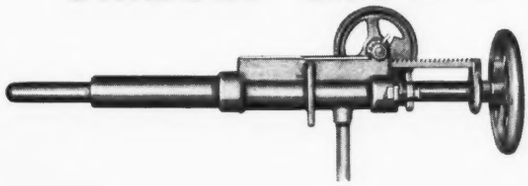
Uses steam or water, or combination of water and steam—and is steam or water cooled when operating. Motor driven, automatic in operation—has many safety features for its own protection—such as automatic retraction should cooling medium fail. Ask for Bulletin No. 906.

DIAMOND "CLYDE" RETRACTABLE BLOWER



A single nozzle blower of exceptionally rugged construction which deals effectively with slag deposits in locations where temperatures are too high for non-retracting blowers. Automatic in operation . . . turning the hand wheel controls steam supply and blowing range in a single operation. Write for Bulletin No. 932.

DIAMOND MODEL I RETRACTING BLOWER



A simple effective means of cleaning water walls and radiant type superheaters. Sometimes used on lower tubes of boiler proper. Nozzle projected into furnace by rack and pinion, then revolved; after blowing, nozzle is racked back into the protective sleeve. See Bulletin No. 906.

When coals having ash of low softening temperature must be burned at high ratings, slagging of boiler tubes often follows. Even though a very small percentage of the total ash adheres as slag, it may gradually build up and cause trouble.

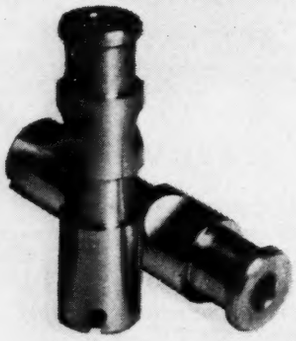
Diamond Deslagging Equipment is in successful operation in many plants where slagging would otherwise cause much difficulty.

Diamond Deslaggers are built with a thorough understanding of modern boiler and furnace practice—applied to the individual job with the effectiveness which comes only after long and varied experience.

DIAMOND POWER SPECIALTY CORPORATION • Detroit, Michigan

DIAMOND SPECIALTY LIMITED • WINDSOR, ONTARIO

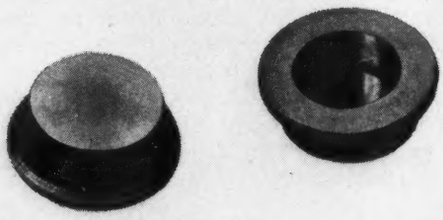
Forestall Replacement Problems!



These 2¼-in. long plunger lever pins for diesel engines are cast of Haynes Stellite alloy and finished by grinding to accurate dimensions.

This cast and ground seat ring for an "anti-coking valve" is used with a Haynes Stellite alloy stem, to withstand heat, abrasion, and corrosion.

Pump rods are made by butt-welding steel or nickel alloy ends to the Haynes Stellite alloy center, where abrasive and corrosive action occurs.



These Haynes Stellite valve stem caps for diesel engines are used to combat severe conditions of abrasion and heat.

use Haynes Stellite Alloy Parts to resist

ABRASION... HEAT... CORROSION

● Machine parts which are made of Haynes Stellite alloy stand up for long periods of use even when subjected to severe abrasion, erosion, heat, or corrosion. For this reason, parts made of this wear-resistant alloy are being used increasingly at vital points to help avoid shutdowns... to reduce maintenance costs... and to forestall problems of parts replacement.

Haynes Stellite alloy specialties ranging in size and shape from phonograph needles to intricate, cored castings like the lever pins shown above are regularly made to order—cast and ground to customers' specifications. Stampings or forgings of a malleable grade are also supplied. For more information, write or phone the nearest district office—today!

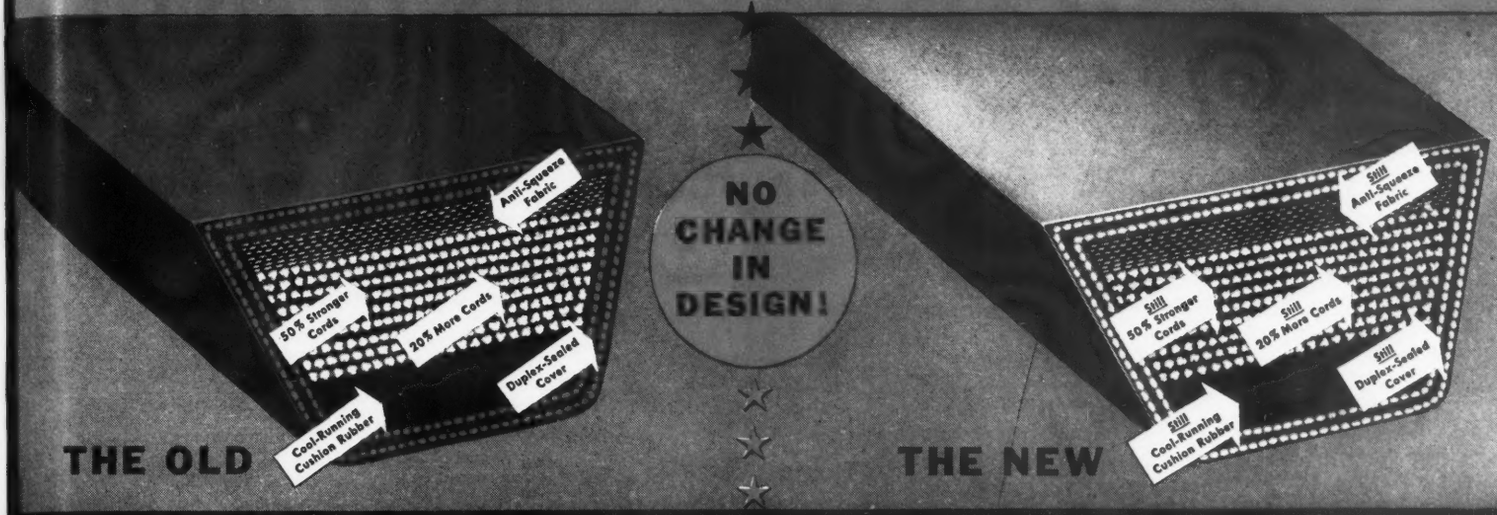
Take Advantage of This Unique Combination of Properties

- Haynes Stellite alloy is inherently hard and abrasion-resistant, even at red heat.
- Haynes Stellite alloy is resistant not only to atmospheric corrosion, but also resists the action of many corrosive materials.
- Haynes Stellite alloy takes a high polish.
- Haynes Stellite alloy has a low coefficient of friction.

"Haynes Stellite" is a registered trademark of Haynes Stellite Company

HAYNES STELLITE COMPANY
Unit of Union Carbide and Carbon Corporation
New York, N. Y. UCC Kokomo, Indiana
Chicago—Cleveland—Detroit—Houston—Los Angeles—San Francisco—Tulsa

Announcing A New Uniform for the famous Red Belt



TEXROPE Goes to a war-time black!

YOU STILL GET . . .

1. The 50% stronger cords made possible by the sensational new Flexon process.
2. The 20% more cords that help give Texrope Super-7 V-Belts their extra "muscle".
3. The increased life provided by Texrope's shock-absorbing, cool-running rubber cushion.
4. The extra protection against grit, grease and dampness of the duplex-sealed cover. The *only* thing changed in cover design is the color!

WHAT: It's a change in Texrope* Super-7 V-Belt *color* . . . from its well-known red to a war-time black. The *only* change in design is in color — and the color change is only skin-deep.

WHY: To free additional stores of red-pigmented rubber for meeting America's special and growing war-time needs, Allis-Chalmers gladly surrenders — on its own initiative — the red surface pigmentation of Texrope V-Belts.

WHEN: Texrope V-Belts are being produced in black *now* . . . and with stocks of red belts on hand you are assured of no curtailment in supply or in the range and number of sizes available.

Texrope's loss in identifying color is Uncle Sam's gain. That's right and proper. And *your* loss is zero. *Every last one of the famous Texrope design features remains the SAME!*

Today, when your production depends on your V-Belt equipment, get *all* the advice and help that's yours for the asking at your Texrope dealer or nearby Allis-Chalmers district office. Or write Allis-Chalmers, Milwaukee, Wis.

*Trade mark registered U. S. Patent Office. Texrope Super-7 Belts are the result of the co-operative research and design genius of *two* great companies — Allis-Chalmers and B. F. Goodrich — and are sold exclusively by Allis-Chalmers. A 1516

Available in all sizes ½ hp to 2,000 hp

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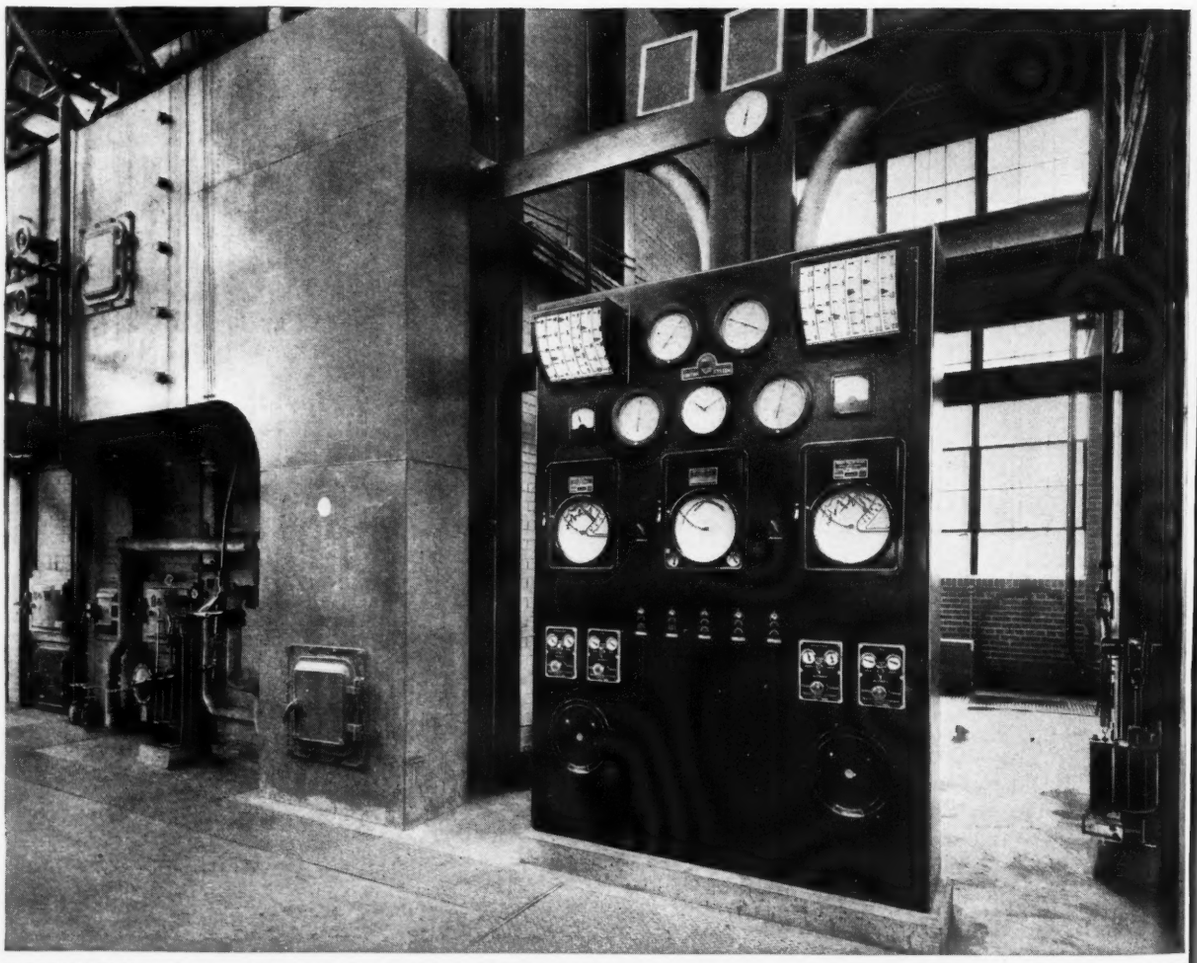
MILWAUKEE · WISCONSIN

WE WORK FOR VICTORY — WE PLAN FOR PEACE

DUREZ INSURES

Bailey Meter Control Economy, Maximum

Two 60,000 lb. per hour capacity pulverized coal fired boilers at the Durez Plant are automatically operated with a maximum of economy, safety and reliability by this Bailey Boiler Control Panel.



BAILEY METER CONTROL . . .

BOILER METERS • MULTI-POINTER GAGES • FLUID METERS • RECORDERS • SUPERHEAT

STEAM ECONOMY

on New Boilers Guarantees Continuous Fuel Operating Safety and Reliable Power Service

★ Durez Plastics & Chemicals, Inc., North Tonawanda, N. Y. have insured a full measure of performance from two new 60,000 lb. per hr. capacity B & W Integral-Furnace Boilers by automatically operating these units with Bailey Meter Control.

In addition to the usual control functions of maintaining steam pressure, regulating furnace draft and distributing load among boilers, Bailey Meter Control offers these plus values;

1. An automatic readjustment of the fuel—air ratio which functions continuously to insure economical combustion at safe furnace temperatures day after day. Fuel is measured on a B. t. u. basis.
2. No control system is better than its metering device—in the Bailey system control impulses are originated by standard Bailey Meters.
3. Provision is made for the protection of steam generating equipment by the addition of purge interlocks, fan failure interlocks, and flame detectors.
4. Experience gained from making installations on over 1000 boilers during the past 5 years is built into each Bailey Control System.
5. Bailey Control Drive Stands and linkage improve the appearance of the boiler room, as well as provide for emergency manual operation.
6. Full time Bailey engineers who are thoroughly trained in problems of combustion and boiler operation are stationed in some 30 conveniently located cities throughout the United States and Canada where they are available to assist you in solving your power problems.

When you face the important task of selecting a control system for your boiler plant, be sure that you get a complete system which will enable you to secure maximum economy, capacity, safety and reliability from your major equipment.

If you do not have a copy of our bulletin No. 102-C in your file, ask for one now.

A-71

BAILEY METER COMPANY

1036 IVANHOE ROAD • CLEVELAND, OHIO

Bailey Meter Company Limited, Montreal, Canada

The Complete Combustion Control System

CONTROL • DESUPERHEAT CONTROL • COMBUSTION CONTROL • FEED WATER CONTROL

DON'T OVERLOOK RESULTS LIKE THIS WITH A-E-CO TAYLOR STOKERS

PROBLEM: The geographical location of a metal working plant made a wide range of Pennsylvania and Ohio coals economically available. The real problem was to select firing equipment capable of burning efficiently coals of widely diversified characteristics.

SOLUTION: After a careful investigation of all available equipment, Taylor Stokers were selected for the job. Two HC6 Taylor Stokers, 4 retorts, 25 tuyeres were placed under the 300 H.P. Stirling boilers.

RESULTS: The decision proved a sound one. During the first five years of service, stoker maintenance averaged less than 1¢ per ton of coal burned.

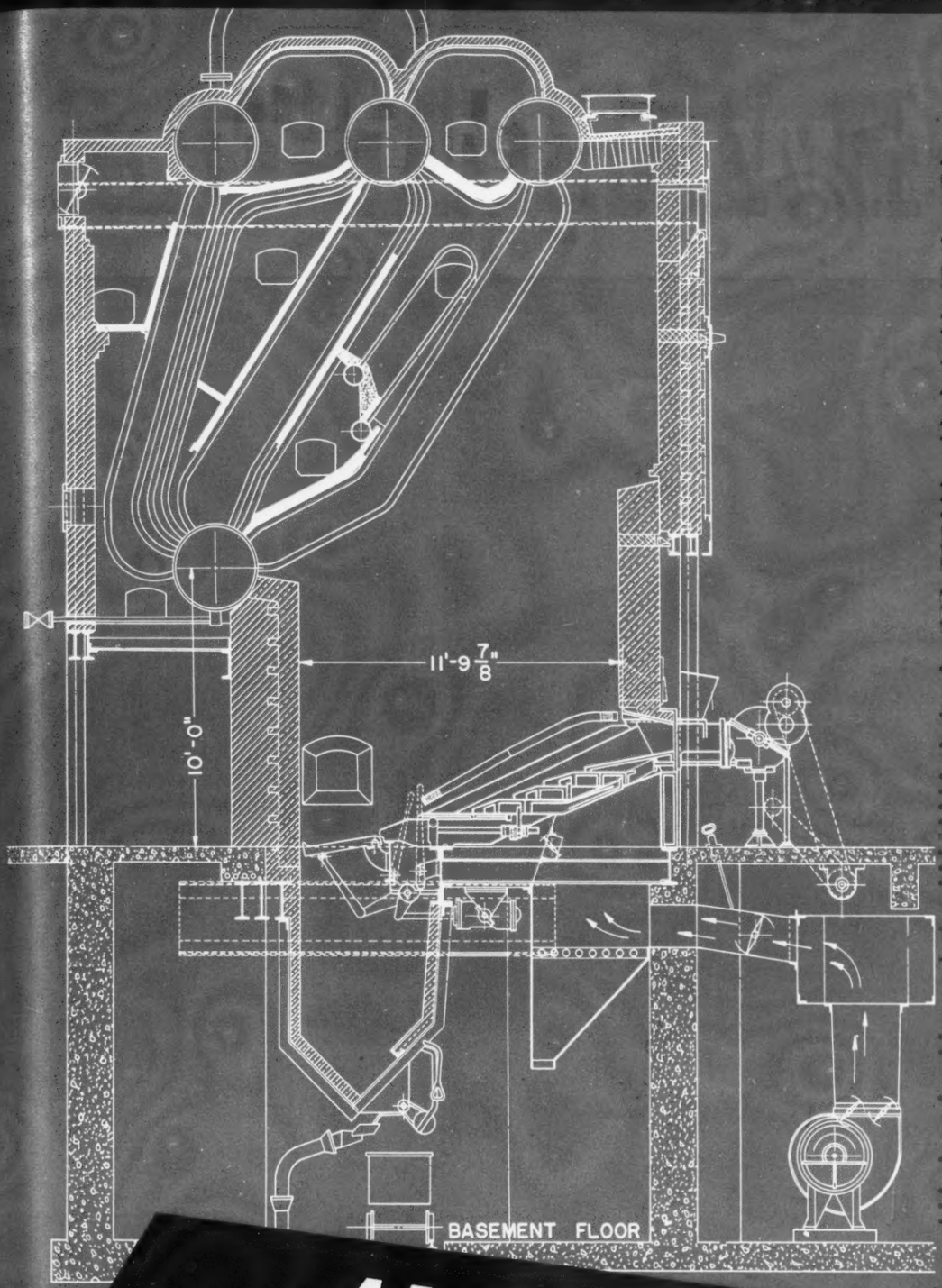
21 different grades of Pennsylvania and Ohio coals have been burned. Ash content varied from 7 to 12%; sulphur from 1 to 3.8%; B.T.U. from 12,000 to 14,000; ash fusing temperatures from 1950 to 2550°F. All coals were burned satisfactorily. Maximum boiler rating obtained: 350% for one hour; 300% for 24 hours. Average summer load: 185% of normal boiler rating. Average winter load: 275% of normal boiler rating.

Boilers were never out of service due to repairs or breakdowns. Operation was continuous except for brief vacation periods when the entire plant was shut down.

A CASE IN THE METAL WORKING INDUSTRY

AMERICAN ENGINEERING

PHILADELPHIA • PENNSYLVANIA



A-E-CO TAYLOR STOKERS ON THE FIRING LINE

*Aluminum Company of America, Edgewater, N. J.
*Aluminum Company of America, New Kensington, Pa.
American Tobacco Co. Inc., Durham, N. C.
Castanea Paper Company, Johnsonburg, Penna.
Chrysler Corporation, DeSoto Plant, Detroit, Mich.
*Collins and Aikman Corp., Roxboro, N. C.
City of Columbus, Ohio
*Consolidated Paper Company, Monroe, Michigan
*Cresson State Sanitarium, Cresson, Penna.
Defiance Milk Products Co., Defiance, Ohio
*DeLaval Steam Turbine Co., Trenton, N. J.
*Detroit Sulphite Pulp & Paper Co., Detroit, Michigan
City of Dover, Ohio
*Draper Corporation, Hopedale, Mass.
Erwin Cotton Mills Co., West Durham, N. C.
*Fisher Body Corporation, Detroit, Michigan
Fisher Body Corporation, Fleetwood Plant, Michigan
*Fisher Body Corporation, Grand Rapids, Michigan
*Fisher Body Corporation, Pontiac, Michigan
Fox Paper Company, Lockland, Ohio
Froedtert Grain and Malting Co., Milwaukee, Wisc.
*City of Galion, Ohio
*Gardner-Richardson Company, Lockland, Ohio
*General Electric Company, Erie, Penna.
*General Electric Company, Fort Wayne, Ind.
*Greenwood Electric L. & W. Plant, Greenwood, Miss.
*Board Public Works, Hannibal, Mo.
Hill School, Pottstown, Penna.
*Hobart Mfg. Co., Troy, Ohio
*City of Holland, Michigan
*Hope Natural Gas Co., Cornwell Station, West Va.
Hudepohl Brewing Co., Cincinnati, Ohio
Industrial Cotton Mills, Rock Hill, S. C.
*City Water & Light Plant, Jonesboro, Ark.
Kohler Company, Kohler, Wisc.
Maryland State Penal Farm, Roxbury, Md.
*Maybury Sanitarium, Northville, Michigan
Michigan Carton Company, Battle Creek, Michigan
*Michigan State College, East Lansing, Mich.
Municipal Light Plant, Marshfield, Wisc.
*Pacific Mills, Lyman, S. C.
*Packard Motor Car Co., Detroit, Michigan
*Municipal Electric Plant, Painesville, Ohio
*Park Drop Forge, Cleveland, Ohio
Pennsylvania Electric Co., Seward, Penna.
*Pennsylvania R. R. Co., Philadelphia, Penna.
*Picatinny Arsenal, Dover, N. J.
*Pittsburgh Plate Glass Co., Barberton, Ohio
Borough of Quakertown, Quakertown, Penna.
Raleigh Wyoming Mining Co., Glen Rogers, W. Va.
*Rhinelander Paper Company, Rhinelander, Wisc.
City of Richland Center, Wisconsin
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*Solvay Process Company, Detroit, Michigan
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Swarthmore College, Swarthmore, Penna.
*Timken Roller Bearing Co., Canton, Ohio
Timken Roller Bearing Co., Gambrinus, Ohio
Municipal Water & Light Plant, Tippecanoe City, O.
City of Toledo, Ohio
*Union Bleachery, Greenville, S. C.
Union Mills Paper Mfg. Co., New Hope, Penna.
*University of Wisconsin, Madison, Wisc.
*Vassar College, Poughkeepsie, New York
*Borough of Vineland, New Jersey
Warfield Natural Gas Company, Harold, Kentucky
White Sewing Machine Co., Cleveland, Ohio
Whiting Plover Paper Company, Stevens Point, Wisc.

(*) *Represents repeat orders.*

A-E-CO TAYLOR STOKER

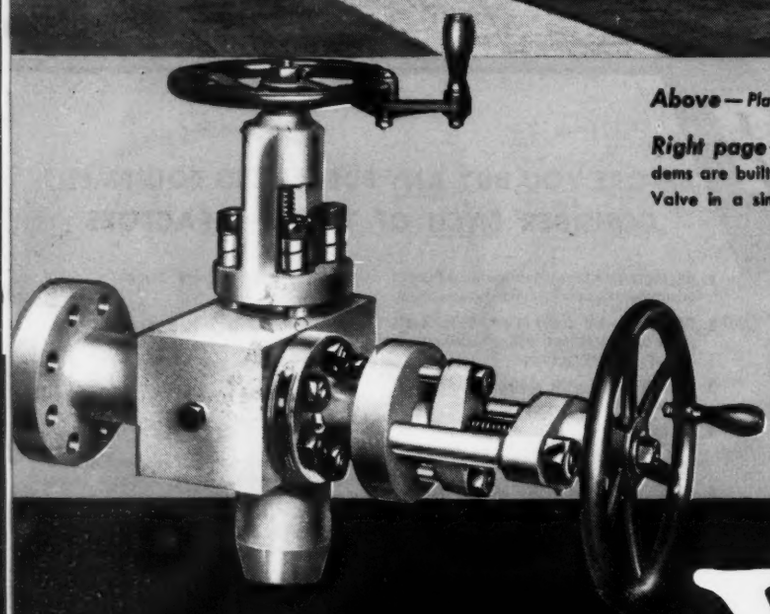
A-E-CO TAYLOR STOKERS
WATER WALLS · ASH HOPPERS
HELE-SHAW FLUID POWER
MARINE DECK AUXILIARIES
LO-HED HOISTS

COMPANY

BEFORE YOU BUY ANY FUEL FIRING EQUIPMENT CONSIDER EACH OF THESE 12 FACTORS

1. **RELIABILITY**—the ability to operate with minimum outage and minimum standby equipment.
2. **CAPACITY**—the ability to provide adequate prime capacity ratings, with sufficient reserve capacity for emergencies.
3. **MAINTENANCE**—the ability to operate continuously with minimum repair costs.
4. **FLEXIBILITY**—the ability to follow the steam demand upward or downward . . . quickly and without sacrificing efficiency.
5. **EFFICIENCY**—the proved dollar efficiency (total cost of steam production) as shown by actual performance in similar installations.
6. **OPERATION**—the ability to operate continuously, the number and type of operations required, the ease of combustion adjustments, etc.
7. **ADAPTABILITY**—the ability to meet special and limiting conditions, present and future—structural limitations, utilization of present equipment, growth and change of power service demands.
8. **FUEL FLEXIBILITY**—the ability to burn efficiently and easily fuels from many sources having widely varying characteristics.
9. **REFUSE DISPOSAL**—the ability to economically eliminate ash or refuse and the opportunities of disposal at low cost, no cost, or profit.
10. **STACK DISCHARGE**—the practical elimination of "smoke nuisance" without special equipment.
11. **SPACE REQUIREMENTS**—the ability to conform to existing or future space limitations, to short and wide or long and narrow furnaces. Also the accessibility of component parts for maintenance and operation.
12. **OBSOLESCENCE**—the adaptability of the equipment toward possible future modernization with minimum of complication and outage.

At Arkwright, Ga.,



Above — *Plant Arkwright, show place of modern efficiency in power generation.*

Right page — Two views of the Yarway Unit-Tandem Valves at Arkwright. Yarway Unit-Tandems are built for pressures up to 2500 lbs per sq. in. Combining a Hard-Seat and a Seatless Valve in a single one-piece forged steel body, this Tandem provides the advantages of both designs—*for blowing and draining and for sealing*—in a compact, rugged unit.

Inside (next to boiler) blowing valve is the Yarway Hard-Seat Valve which utilizes special Stellited seat and disc and unique construction features to resist wear in this type of valve. Outside sealing valve is the famous Yarway Seatless design which has no seat to score, wear and leak. This master valve is always opened first and closed last, maintaining a tight seal under expansion and contraction.

YARWAY

it's YARWAY Unit-Tandems Throughout

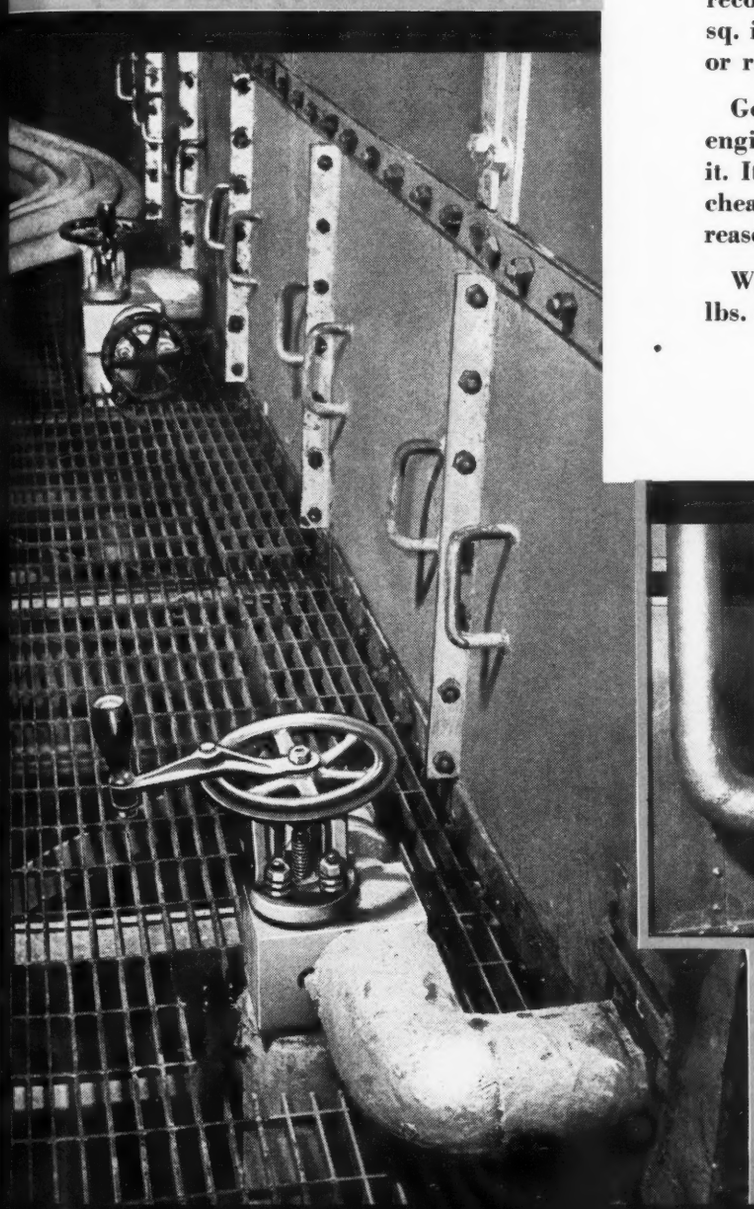
Plant Arkwright—modern steam plant built to augment the water power system of the Southeast—is a notable addition to the Georgia Power Company facilities.

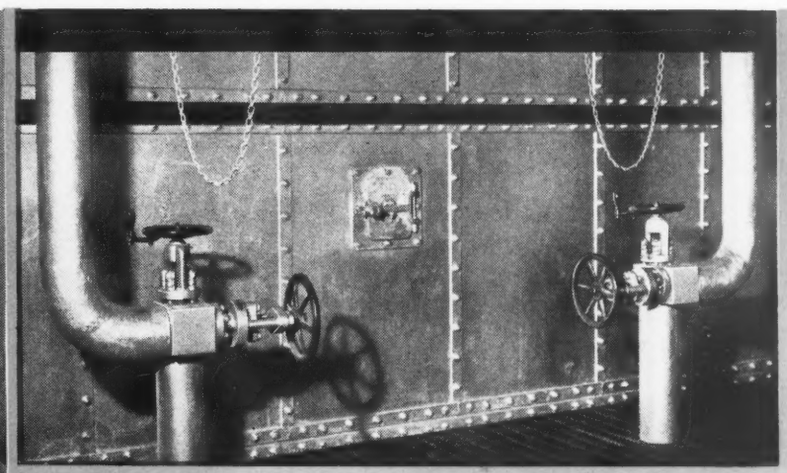
All three boilers of this high pressure plant are completely equipped with Yarway Unit-Tandem Blow-Off Valves—*equally suitable for blowing or draining and for sealing*—the valves that have made such records as "3000 blows at more than 1300 lbs per sq. in. pressure without replacement of a single part or repairs of any nature."

Good boiler engineering demands equally sound engineering in the accessories that become a part of it. It is not only protection for your investment, but cheap insurance against trouble and expense—the reason why most people specify Yarway Blow-Off Valves.

Write for Catalog No. 431 for pressures up to 2500 lbs. Catalog No. 421 for lower pressures.

YARNALL-WARING COMPANY
100 Mermaid Ave. Philadelphia, Pa.





BLOW-OFF VALVES

It took us 4 years to build the first 1000 Eye-Hyes

In 10 months more we built the second 1000

Reliance EYE-HYE No.

Part of a Westinghouse International

Acceptance of this dependable, accurate, remote-reading water-level indicator spreads rapidly on land and sea . . .

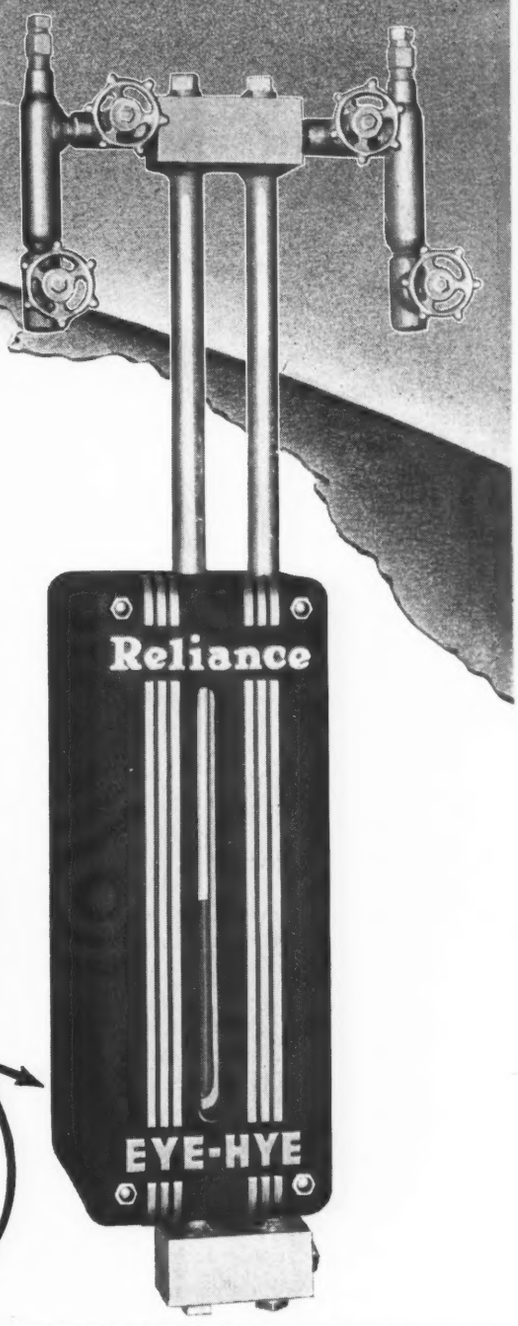
RELIANCE GAUGE COLUMN CO. EYE-HYE
CLEVELAND, OHIO
1000th EYE-HYE SHIPPED
New Remote-Reading Reliance Water Gage Adds Safety to Boilers Everywhere. Prominent Mid-West Utility Gets EYE-HYE No. 1000
Reliance

This advertisement appeared in POWER last July, announcing the shipment of EYE-HYE No. 1000 (part of an order for *four)* to the new No. 2 plant of Union Electric Company at Venice, Ill. Singularly, EYE-HYE No. 2000 likewise is one of four of the same model—ordered by Westinghouse International.

Reliance

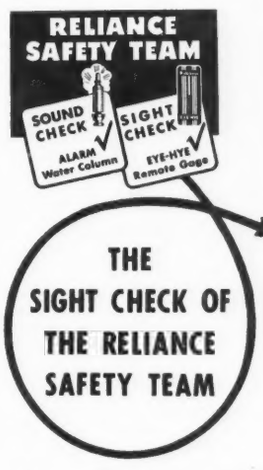
2000 is sailing Overseas

order for our [CENSORED]s



EYE-HYE is still new — only five years old — yet it has won the confidence of engineers in both stationary and marine power plants. For this unusual means of carrying a true water level reading any reasonable distance from the boiler drum is a valuable time-saving facility and a protection from the danger and expense of water level accidents. . . . In many hundreds of power plants and on ships of all types, EYE-HYE delivers distinct accurate indication to control stations wherever you want them. Now EYE-HYE No. 2000 and three of its mates sail to a foreign land, though not the first to take the Reliance SIGHT Check for boilers to modern installations overseas.

EYE-HYE brings water level reading *down,* where operators see it often. Connections from the drum are two flexible tubes which can follow the most convenient route — around pipes and girders, and through walls. Water is indicated in illuminated green liquid; steam or empty space in clear white light. Models for wall or panel mounting. Easy to install, maintenance practically nil. *Write for full description of the* EYE-HYE, *Bulletin 382.*



THE RELIANCE GAUGE COLUMN CO.
CLEVELAND, OHIO

BOILER SAFETY DEVICES

HOW TO MAKE YOUR STOKERS

. . with less outage and

If this information is not of immediate interest to you, please see that it reaches the proper man in your organization.

If yours is one of the many plants operating single-retort, underfeed stokers, here are some suggestions that will help you get longer life out of your present equipment and minimize outage for repairs or replacements. While they relate primarily to the three C-E underfeed stokers here illustrated, they are largely applicable to all single-retort, underfeed types.

OPERATION

GENERAL The two main causes of excessive outage and maintenance are **(1)** sustained or frequent overloading of stoker and **(2)** operating with insufficient draft.

Where prolonged overloading is unavoidable, as is often the case in these days, good operation and careful attention to maintenance are especially important. Frequently, in such cases, the use of a higher quality coal will make it possible to carry the increased load without excessive outage or maintenance costs.

Where difficulties are due to insufficient draft, the suggestions here under the heading "Draft" may prove helpful.

FIRE **(1)** Keep fire out of retort. This condition can result from too thin a fuel bed, from banking with insufficient fuel or from running with an empty hopper.

(2) Operate so that ends of grate bars adjacent to dump grates are always covered. Watch this condition after operating dump grates, and, if ends of bars are bare, speed up stoker until they are covered.

(3) Working of fire should be avoided as much as possible. If fuel bed requires leveling off, light rake or T-bar should be used on surface of fire. Never slice the fire as is done in hand firing by pushing a bar under the fire and raising it through the fuel bed.

(4) Be sure that fuel distributes uniformly over grate. Position of pusher blocks in retort can be adjusted to assure proper distribution.

(5) Be sure to feed sufficient fuel when banking. May be necessary to renew supply during long banking periods.

(6) In cleaning fire, do not remove ash and clinker that remain on grate bars after dumping. Allow them to move down on to cleaned dump grates by normal operation of stoker.

(7) Don't permit too much ash to accumulate in ash pit.

(8) When stoker is being shut down, sufficient ash should be fed in to keep fire out of retort.

(9) Depth of fuel bed is very important. If too thin, fire may burn down into retort and damage retort sides. If too heavy, poor air distribution will result, causing spotty, uneven fire; holes in fuel bed; smoke and reduced efficiency. Correct depth of fuel bed above top of retort may be anywhere from 4 in. to 8 in., depending upon analysis and burning characteristics of coal used.

DRAFT **(1)** Draft gage and a CO_2 indicator are essential to good operation.

(2) Operate with slight draft just above fuel bed — preferably 0.10 in; not less than 0.05 in. Plus pressure will cause excessive temperatures at grates and lower wall areas.

(3) Maintain proper supply of air at all times. Either too much air or too little air will reduce efficiency and capacity.

(4) Some air should be allowed to pass through grates at all times except when fire is banked.

(5) Don't force stoker beyond capacity of stack to carry away gases.

(6) Keep wind boxes properly sealed to prevent leakage of air into ash pit and furnace.

(7) If draft is insufficient, check leaks in setting and losses through boiler and flue connections; check position of boiler damper. Careful checking will usually disclose conditions that can be improved.

CLEANING **(1)** Remove siftings from wind boxes often enough to prevent any possibility of fire under grates. Frequency of cleaning depends upon type of fuel used, but wind boxes should be inspected once every shift.

(2) Keep front of stoker clean to prevent contamination of lubricants and excessive wear on moving parts.

INSPECTION & MAINTENANCE

(1) All accessible parts of the stoker should be inspected daily. Those parts which cannot be examined while the stoker is in service should be thoroughly inspected at least twice a year and more often if practicable.

(2) On daily inspections, look especially for loose bolts and loose connections in moving parts. Where movement is transmitted by sheer pin, or safety release, be sure there is no binding which might prevent protective device from serving its function. Make repairs or replacements promptly.

(3) When stoker is shut down, make thorough inspection. Check wear on surfaces of feeder box sides, conveyor tube and retort. (If they are allowed to get too thin before replacement, serious outage will result.) Check wear on moving parts, check alignment: Check condition of dump grates. On stokers equipped with moving grate bars, check move-

LAST LONGER..

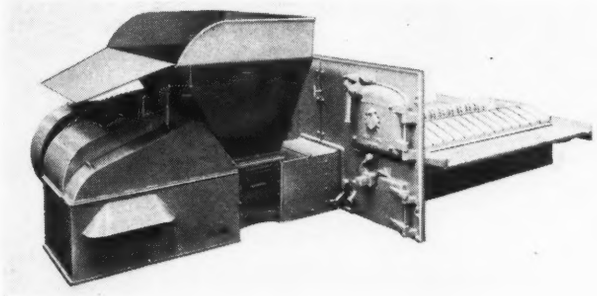
lower maintenance !

ment of bars and see that proper clearances are maintained. Overall clearances to provide for growth of grate bars should be 1½ in. on small stokers and up to 2 in. on large stokers. If stoker has adjustment device to compensate for growth, use hand pressure only on adjusting screw. Where there is no adjusting device, remove grate bar or filler bars as may be necessary to provide proper clearance. (Excessive tightness of bars, usually resulting from growth, can cause extensive damage.)

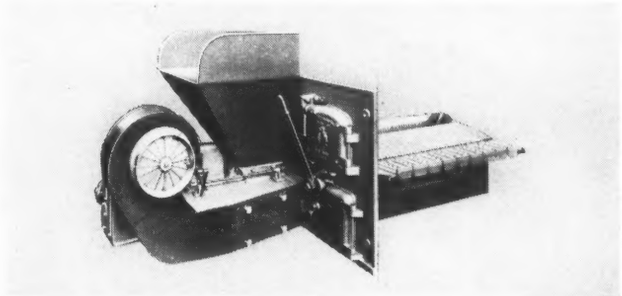
LUBRICATION

The use of the right lubricants at sufficiently frequent intervals at all points requiring lubrication is essential if unnecessary outages and excessive maintenance are to be avoided. Difficulties from inadequate lubrication usually result from a lack of attention rather than a lack of knowledge as to how, when and where to lubricate. A definite schedule for lubrication, regularly adhered to, is the answer.

TYPE E... A single-retort, underfeed stoker designed to burn either coking or non-coking bituminous coals. Applicable to boilers ranging from 150 to 600 rated boiler hp. Equipped with integral steam piston, electric or hydraulic drive.



SKELLY... A single-retort, underfeed stoker available in designs for burning either anthracite or bituminous coal. Applicable to boilers ranging from 20 to 200 rated boiler hp. Equipped with either electric or steam drive.



LOW RAM... A ram type, underfeed stoker designed to burn either coking or non-coking bituminous coal. Applicable to boilers ranging from 35 to 200 rated boiler hp, especially where head room and furnace volume are limited.

The C-E line of stokers is the most extensive on the market. It includes single retort, multiple retort, spreader, traveling and chain grate types.

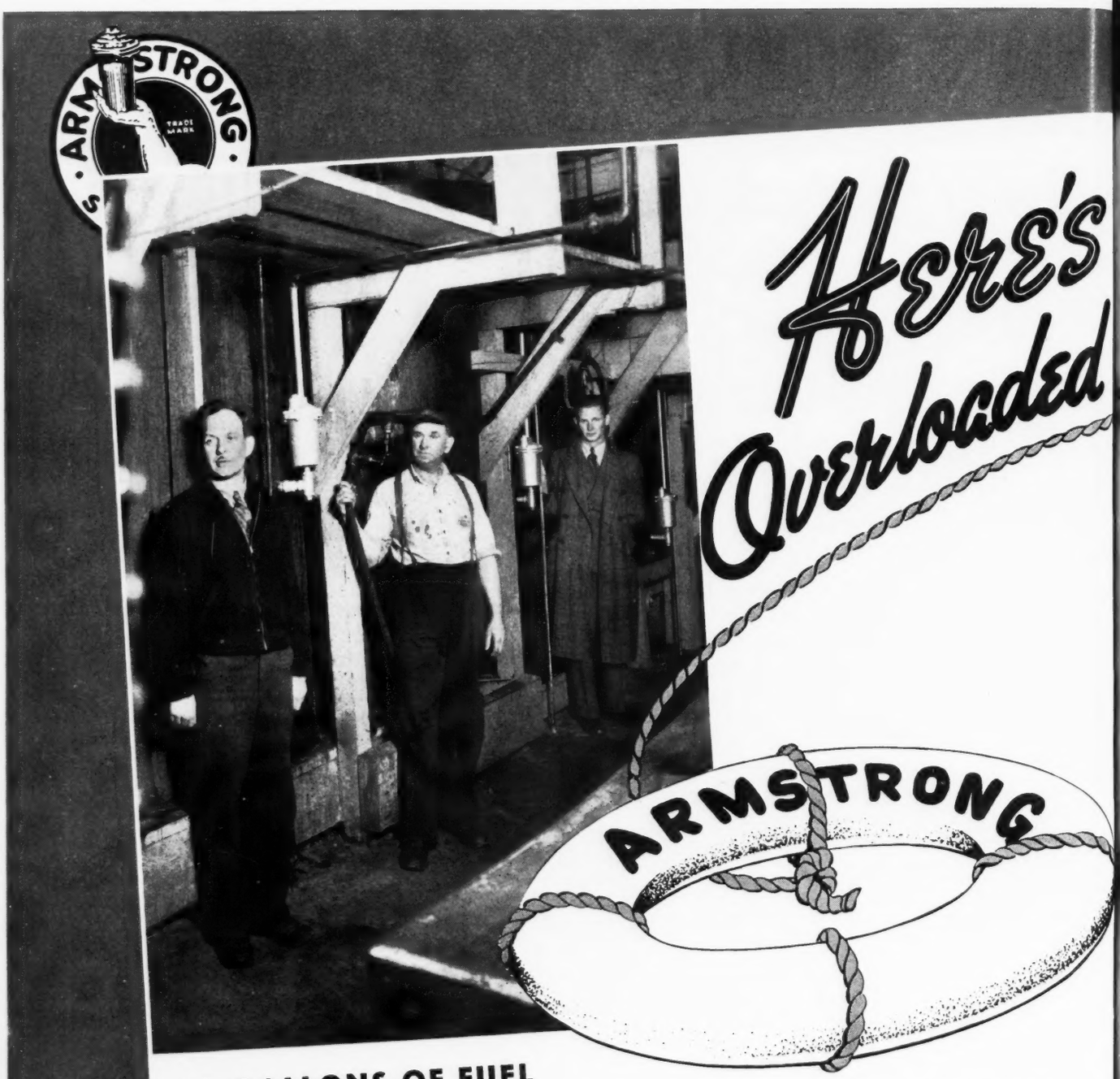
OVER 17,000 C-E STOKERS HAVE BEEN PURCHASED TO DATE

Reprints of this advertisement on heavy paper available on request

A-668

COMBUSTION ENGINEERING

COMPANY, INC. • 200 MADISON AVENUE • NEW YORK, N. Y.

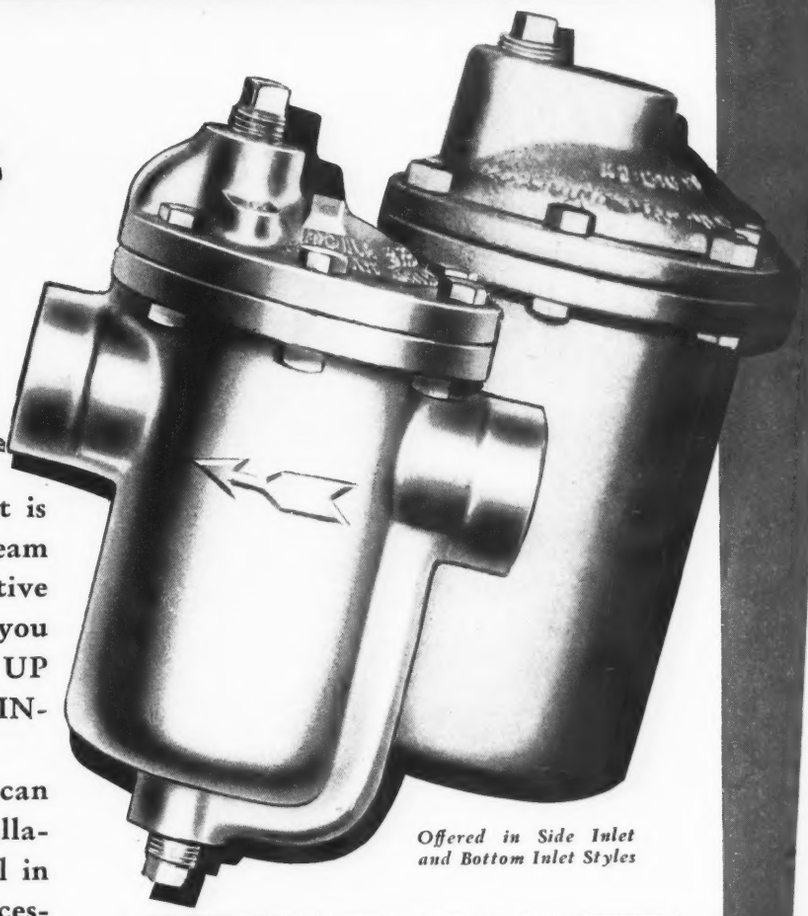


12 GALLONS OF FUEL OIL SAVED PER HOUR and a corresponding increase in available boiler capacity for an investment in Armstrong traps totaling less than $125.00 — that is the record reported for the Stevenson, B.C., fish oil reduction plant of British Columbia Packers, Ltd. Some of the traps are shown in the above picture. That these traps proved to be a real "lifesaver" in easing the load on the boiler is indicated by the fact that the company was right on the point of ordering another boiler.

ARMSTRONG MACHINE WORKS
812 Maple Street
Three Rivers, Mich.

ARMSTRONG *Inverted Bucket*

HELP for Boilers!



Offered in Side Inlet and Bottom Inlet Styles

GIVE your boilers the help that is now vitally needed! Cut out the steam waste occasioned by leaky, ineffective traps. Let Armstrong traps help you CUT STEAM LOSSES, SPEED UP HEATING, AND REDUCE MAINTENANCE REQUIREMENTS.

How effective this steam saving can be is indicated by numerous installations where a few pounds of metal in Armstrong traps have made unnecessary the purchase of hundreds of pounds of new boilers. The installation shown at the left is a typical example.

Armstrong traps are guarding steam system efficiency on land and sea all over the world. Armstrong representatives have had wide experience in helping plant engineers solve individual trapping problems. Take advantage of the help they can give you.

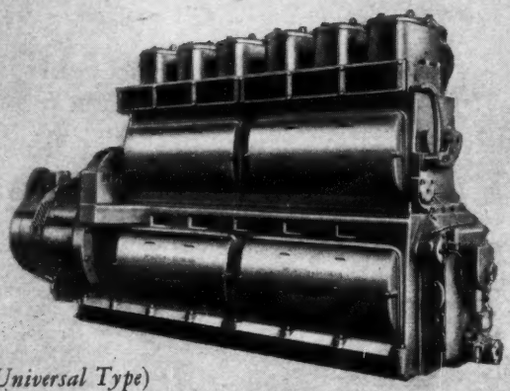
SEE OUR CATALOG IN SWEET'S

FEATURES Operating Engineers want in Steam Traps:	THE ARMSTRONG STEAM TRAP:
1. Ability to draw off air.	✓YES
2. Ability to handle hot condensate.	✓YES
3. Ability to handle all ordinary sediment and sludge.	✓YES
4. Freedom from wire-drawing in orifice.	✓YES
5. No steam loss for any load condition.	✓YES
6. Ability to hold tight against vacuum.	✓YES
7. Freedom from friction and wear.	✓YES
8. Small size — light weight.	✓YES
9. Simple construction.	✓YES
10. Large capacity.	✓YES

STEAM TRAPS

Saving Fuel, Metals and Manpower for the Battle of Production

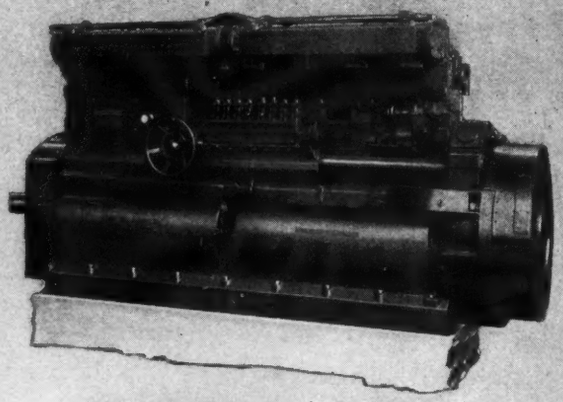
Alco DIESEL ENGINES



(Universal Type)
McIntosh & Seymour Four Cycle Stationary Diesel Engine.

The Diesel Engine Division of the American Locomotive Company, recognizing the inherent advantages of both the two cycle and the four cycle principle for certain particular problems, is in the enviable position whereby it can recommend a known perfected design of the right type for a particular job.

McIntosh & Seymour Type, Four Cycle, Stationary Diesel Engine.

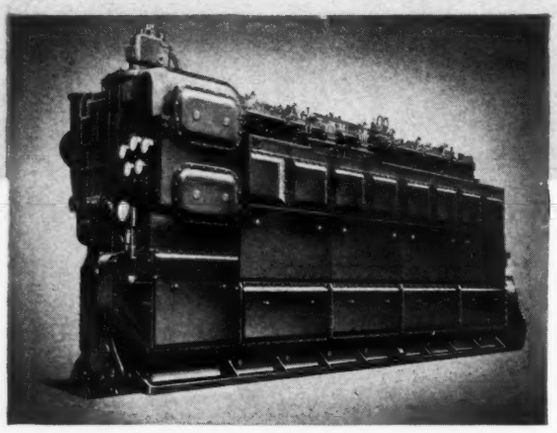


McIntosh & Seymour Type, Four Cycle, Marine Diesel Engine (Universal Type).

McINTOSH & SEYMOUR TYPE
FOUR CYCLE, VERTICAL DIESEL ENGINES

No. Cylinders	B. Hp.	R. P. M.	Bore	Stroke
6	540	600	12½"	13"
8	720	600	12½"	13"
6*	810	600	12½"	13"
5	730	257	17½"	25"
6	875	257	17½"	25"
8	1170	257	17½"	25"

* Turbo Charged.



Alco-Sulzer Type, Two Cycle, Marine Diesel Engine.

ALCO-SULZER TYPE
TWO CYCLE, VERTICAL DIESEL ENGINES

No. Cylinders	B. Hp.	R. P. M.	Bore	Stroke
4	720	277	14"	23½"
5	900	277	14"	23½"
6	1080	277	14"	23½"
8	1440	277	14"	23½"

AMERICAN LOCOMOTIVE COMPANY
DIESEL ENGINE DIVISION
AUBURN, NEW YORK

Now! COMPLETE PROTECTION IN A 2300-VOLT CONTROL UNIT

- ✓ **Short-circuit Protection**
- ✓ **Accurate Overload Protection**
- ✓ **Safety for Operating Personnel**

LET'S take this new 2300-volt, 60-cycle control unit apart and see what you get. It's really a great team—the EJ 2 current-limiting fuse and our dependable heavy-duty oil-immersed contactor. We have combined them in one metal-enclosed unit to give you complete protection plus long-lived operation.

1ST THE EJ 2 CURRENT-LIMITING FUSE

EJ 2 fuses mean split-cycle short-circuit protection. Current is cut off in less than a quarter cycle and cleared in less than a half cycle — long before the short has had time to harm the starter or motor. Changing these fuses is a simple, speedy operation. Also, they have a disconnect feature, which makes possible complete isolation of individual starters without causing the entire motor line to be shut down.

2ND THE OIL-IMMERSED CONTACTOR

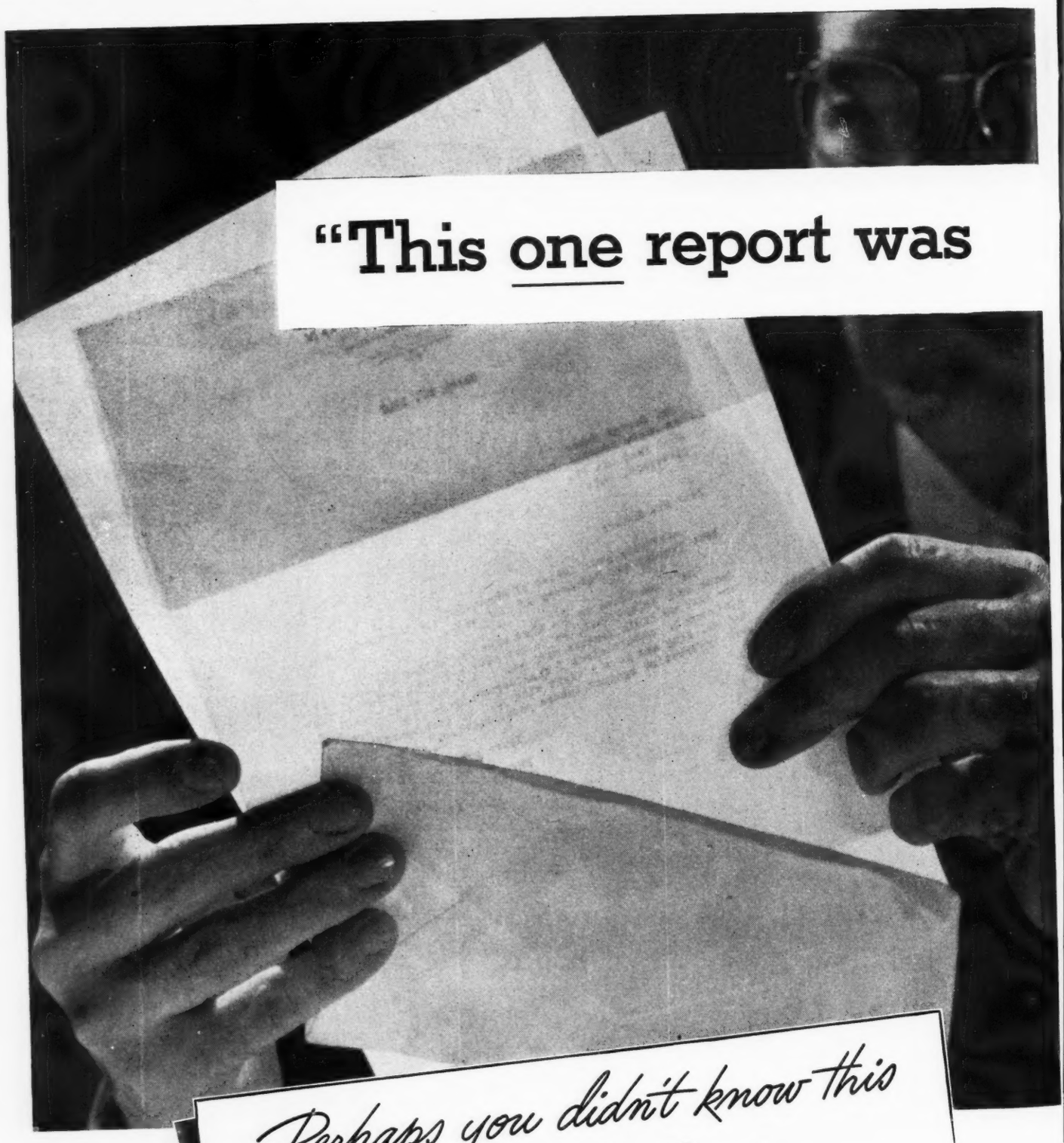
This heavy-duty, corrosion-resisting contactor has a record of years of successful service. Extra-heavy, self-cleaning copper tips, wide metal bearings, and extra-flexible, copper-braided shunts combine to give you a contactor that will withstand more than a million operations with only routine maintenance. Isothermic overload relays calibrated accurately against the actual characteristics of your motor protect both it and the starter against damage from sustained overloads.

The current-limiting fuse and the oil-immersed contactor are mounted together in one metal-enclosed unit—a compact, easily installed, completely protected motor control.

You'll want complete information. Our new bulletin tells not only about protection, but also why you can expect long life with low maintenance costs from this new control. Ask the nearest G-E office for GEA-3660. General Electric Company, Schenectady, N. Y.

GENERAL ELECTRIC

662-4-152



"This one report was

Perhaps you didn't know this about Hall Service:

You can't be a Hall client and get into trouble you are unable to account for without its becoming our immediate concern. Such difficulties usually require a scientific interpretation. That's where Hall's complete service fits in. We spare neither cost nor time to see your plant through its difficulty.

If anyone ever tells you this elaborate background of skilled technicians and laboratory set-up is unnecessary in water conditioning service, ask him why the finest steam plants on land and sea, staffed with the most competent operators obtainable, use Hall Service year after year —would not think of doing without it.

worth the cost of Hall Service to us for 15 years!"

—PLANT SUPERINTENDENT FOR AN IMPORTANT CENTRAL STATION

HERE is one of many instances which illustrate what makes Hall Service supremely different from any other.

The scene is laid in the central power station of a network serving vital war industries—a Hall client since 1927.

Tube burnouts in certain new high-pressure boilers were causing serious interruptions to service. The operators had no way of accurately determining the cause. They suspected improper circulation. But, if this was the case, what would account for the peculiar deposit found on the walls of the burned out tubes? Would that indicate improper water conditioning? An answer had to be found or the trouble was bound to continue.

So they did what any good Hall client does. They turned the problem over to the service. A sample of the deposit was sent to the laboratory.

A quick, partial analysis showed definitely that the deposit was of unusual composition. Further, intensive examination and rechecking were clearly indicated. This work was done.

What followed is typical Hall procedure. The director of the service, together with technicians, went into a round-table huddle. Before them were the laboratory reports, the operating history of the plant, the field engineer's report on the history of the tube failures. The whole situation was explored.

The interpretation which followed was as clear as crystal. Without any doubt it established the fact that the tube failures were *not* the result of the deposit found, but rather that the deposit was the result of overheating of the tube metal due to insufficient circulation of the boiler water. This was framed in a report which clearly gave the answer the plant superintendent needed. He now knew exactly what to do to correct his trouble.

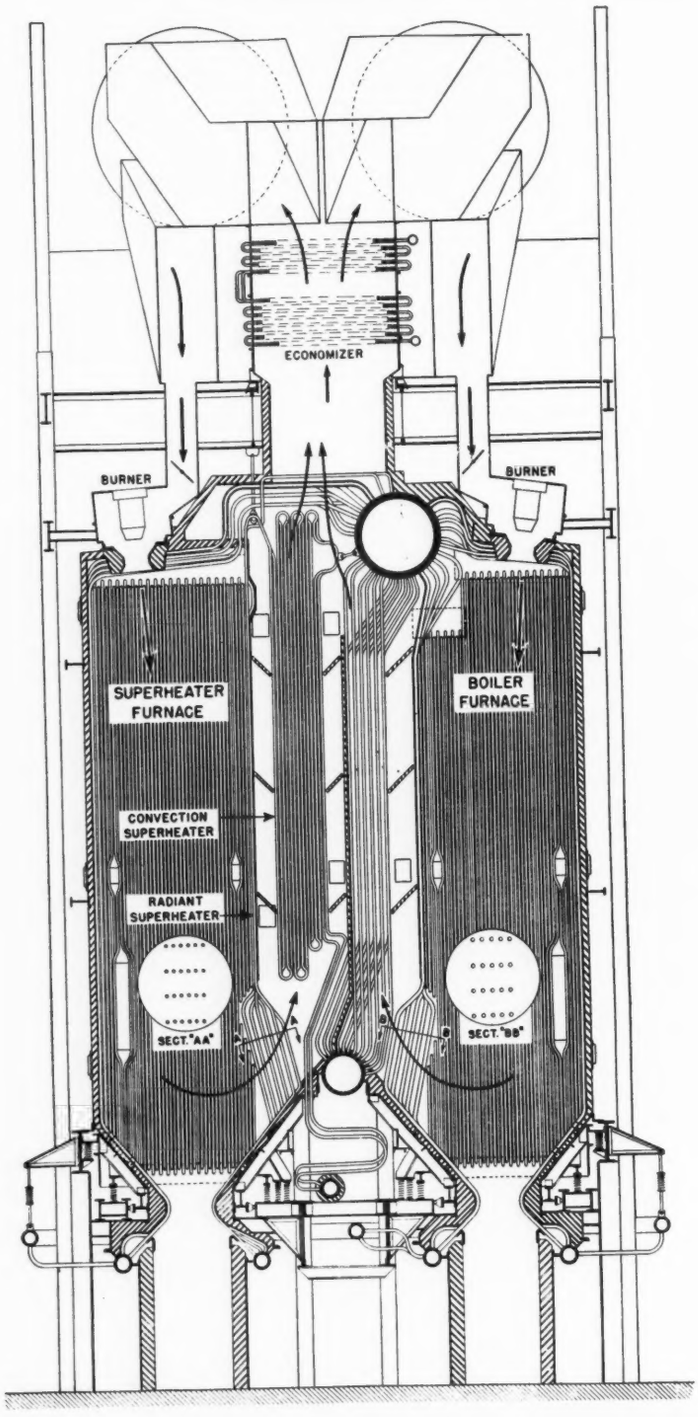
And that was what induced the superintendent to say to our Hall representative, "This *one* report was worth the cost of Hall Service to us for 15 years."

HALL LABORATORIES, INC.
HAGAN BUILDING PITTSBURGH, PA.

HALL SYSTEM
of Boiler Water Conditioning

TWIN FURNACES FOR

DUQUESNE LIGHT COMPANY —FRANK R. PHILLIPS STATION



FOSTER

CENTRAL STATIONS

The twin furnace steam generator was designed to provide satisfactory adaptations of four essential characteristics for central station service.

1. SLAG FREE OPERATION

Furnace gases reduced below slagging temperature before entering boiler or superheater heating surfaces by; (1) increasing waterwall surface 25 to 40% (2) separately fired superheater furnace which gives absolute control of final steam temperature.

2. WIDE RANGE OF SUPERHEAT CONTROL

Radiant and convection superheaters have complementary characteristics which in themselves provide constant steam temperatures over wide load range. Range of superheat can be further increased by differential firing of boiler and superheater furnaces.

3. MAINTENANCE OF SAFE METAL TEMPERATURES IN SUPERHEATER

Overheating of superheater is avoided by firing the boiler furnace only when starting up.

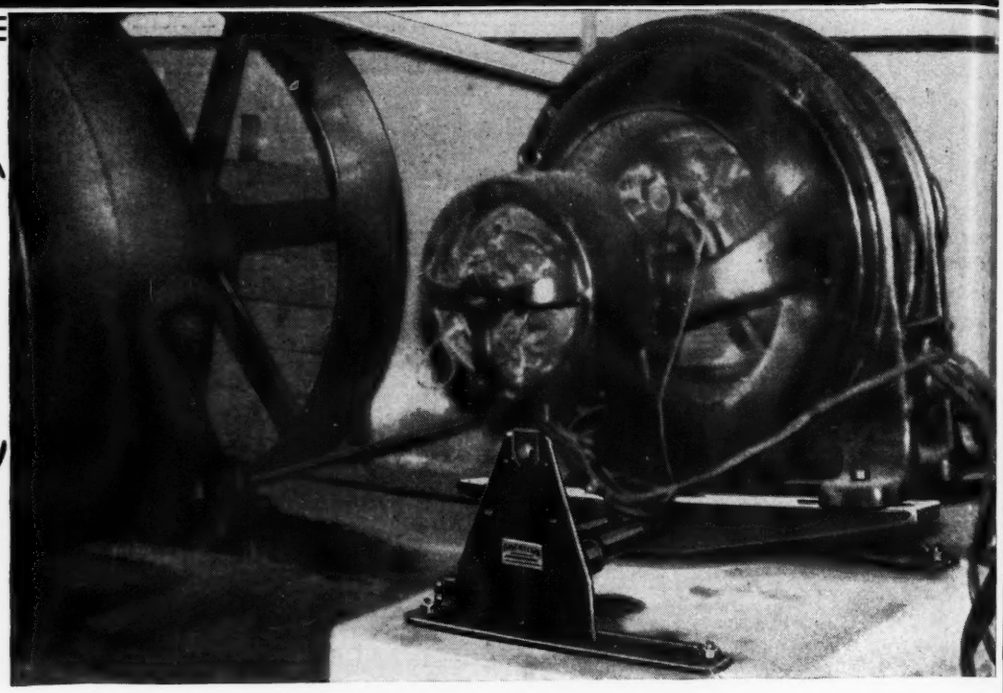
4. HIGH AVAILABILITY

Slag-free operation and elimination of superheater overheating afford high availability and dependable performance.

FOSTER WHEELER CORPORATION, 165 BROADWAY, NEW YORK, N. Y.

WHEELER FW

Belt Life is DOUBLED *with* AMERICAN



*Econ-O-Matic Drives are short-center drives, either flat-belt or V-belt, with American Motor Bases for *automatic* tension control . . . thus belts can't slip, and average belt tension is reduced. Belt life is at least doubled, as proved in many Econ-O-Matic installations.

American Econ-O-Matic* Flat-Belt Drive

Lengthens Belt Life in Texas Ice Plant

"One of the most effective drives I've ever seen," says Mr. D. G. Massey, Chief Engineer, about the **Econ-O-Matic Flat-Belt Drive** shown above operating a 60 KW generator at the Pacific Ice & Cold Storage Company, Dallas, Texas.

This **Econ-O-Matic Drive** is certainly a *belt-saver*... Before it was installed, belt slippage on the previous long-center (18′ 0″) drive was about 5%. Belt repairs were frequent. *A new belt was needed every two years.* Power and maintenance costs were unnecessarily high.

Now, with **Econ-O-Matic** efficiency on the job, belt slip has disappeared. Belt repairs have been nil! The present shorter flat-belt (7′ 6″ center distance) has been in service more than a year and is expected to give *many more years of trouble-free performance.*

Also, Mr. Massey reports power savings, lower maintenance cost and a valuable addition in floor space with this short-center **Econ-O-Matic Drive.**

HINT: Belts are getting scarce these days. *Conserve* the belts you have as well as those you expect to buy! Equip your power-driven machinery with **Econ-O-Matic Drives** . . . You'll *double* belt life! Our engineers will gladly prove this statement. **Write us** *today!*

What You Can Expect from American Econ-O-Matic Drives

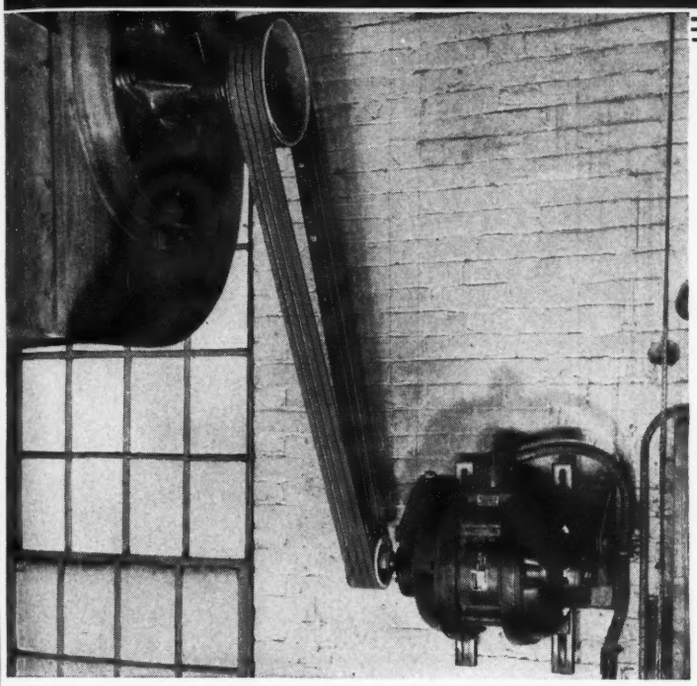
- ★ Belt life increased 100% or more.
- ★ Increased production because correct RPM level is sustained . . . no belt slip.
- ★ Bearing pressure reduced by 50%. Bearings last longer.
- ★ Power savings soon pay the entire low cost of an Econ-O-Matic Drive.
- ★ Man-hours and materials required for maintenance reduced an average of 75%.

Let our engineers prove these economies to you!

The American

4242 WISSAHICKON AVENUE

Econ-O-Matic* DRIVES



AMERICAN Drive Selection Service

BELTS MUST LAST!

Belting is becoming increasingly difficult to obtain. Belts *must* be made to last longer . . . and here's how to do it:

1. Select the right belt or belts and drive for each operating condition. Get the expert advice of AMERICAN DRIVE SELECTION SERVICE.
2. Keep belt tension at proper level . . . don't overload belts or permit slippage. **American Econ-O-Matic Drives** automatically control belt tension and thus *double* belt life.
3. On both new and existing installations specify **American Econ-O-Matic Drives**—They will provide that 100% greater belt wear.

American Econ-O-Matic* V-Belt Drive

Cuts Belt Wear 94.3% in Candy Factory

"During four years of service, we've hardly spent a nickel on maintenance of the **American Econ-O-Matic V-Belt Drive** that operates our plant ventilating fan," declares Mr. H. B. Thompson, Chief Engineer, Peter Paul Candy Company (Collins Division), Philadelphia.

Before the **Econ-O-Matic Drive** was installed belt slippage was troublesome, and belts had to be replaced about *every two months!* Fan and motor bearings frequently had to be replaced.

After the **American Econ-O-Matic V-Belt Drive,** complete with Wedgbelt Pulleys, four Wedgbelts (V-belts), and American Motor Base, was installed, belt life increased 1800%!

1. No new bearings have been needed for either fan or motor in four years.
2. Fan speeds are being maintained, providing higher efficiency and savings in power.
3. Maintenance costs in man-hours and materials have been cut drastically. Scarce materials are being *conserved.*

New! **The American Pulley Company**
4242 Wissahickon Ave., Philadelphia, Pa.

The American Econ-O-Matic Drive Catalog. Tells in words and pictures how to double belt life. Get your copy.

*My Name*_____

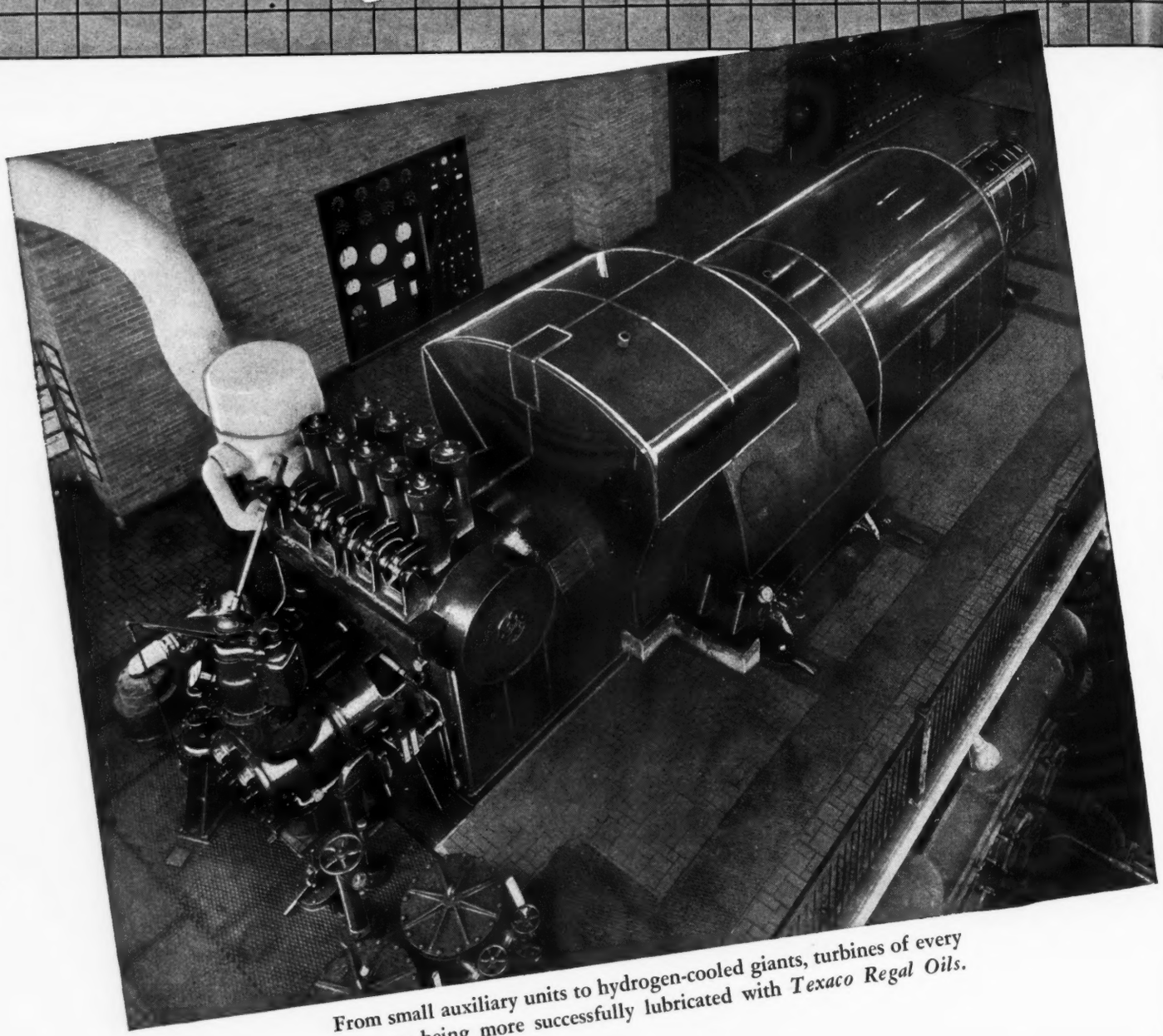
*Position*_____

*Company*_____

*Address*_____

American Pulley Company
PHILADELPHIA, PA.

POWER LOADS LIKE THIS



From small auxiliary units to hydrogen-cooled giants, turbines of every type are being more successfully lubricated with *Texaco Regal Oils.*

TEXACO

TEXACO

TURBINE SPEED LIKE THIS

Despite the increasing fluctuations of war-time power loads, your turbine governors will respond instantly, assure "straight-line" speed graphs, when you use *Texaco Regal Oils.*

Texaco Regal Oils separate rapidly from air and water, are highly resistant to oxidation, emulsification, gum formation and sludging. They keep lubricating systems clean, maintain normal bearing temperatures, insure smooth, sensitive governor action.

The outstanding performance that has made Texaco preferred in the fields listed in the panel has made it preferred by prominent turbine operators everywhere.

These Texaco users enjoy many benefits that can also be yours. A Texaco Lubrication Engineer will gladly cooperate . . . just phone the nearest of more than 2300 Texaco distribution points in the 48 States, or write:

The Texas Company, 135 East 42nd Street, New York, N. Y.

THEY PREFER TEXACO

★ More locomotives and cars in the U. S. are lubricated with Texaco than with any other brand.

★ More revenue airline miles in the U. S. are flown with Texaco than with any other brand.

★ More buses, more bus lines and more bus-miles are lubricated with Texaco than with any other brand.

★ More stationary Diesel horsepower in the U. S. is lubricated with Texaco than with any other brand.

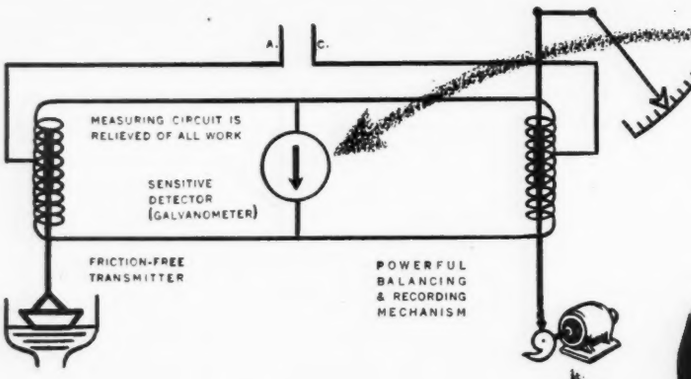
★ More Diesel horsepower on streamlined trains in the U. S. is lubricated with Texaco than with all other brands combined.

FOR YOUR ENJOYMENT
FRED ALLEN every Sunday night. See your local newspaper for time and station.

Care for your Car ..for your Country

HELP WIN THE WAR BY RETURNING EMPTY DRUMS PROMPTLY

REGAL OILS
FOR ALL TURBINES


MEASURING CIRCUIT IS RELIEVED OF ALL WORK
SENSITIVE DETECTOR (GALVANOMETER)
FRICTION-FREE TRANSMITTER
POWERFUL BALANCING & RECORDING MECHANISM

AMPLE POWER

Directed by a

PILOT

That's the principle of the NULL BALANCE METHOD employed in the

COCHRANE

Friction-Free

FLOW METER

THE null or zero balance method consists in balancing the unknown quantity by adjusting a known quantity of the same kind, a highly sensitive detector being used to determine the point of balance.

A friction-free transmitter serves as the pilot for an external motor drive which restores the electrical bridge to balance and operates pen, indicator and integrator with high and equal power throughout the entire scale.

NOTE: A bridge circuit alone is *not* a null method meter. A galvanometer is required to detect unbalance and an external source of power is needed to restore balance. These are found ONLY in the Cochrane Electric Flow Meter.

Send for 56-page "Flow Meters by Cochrane"

COCHRANE CORP., 3106 N. 17th ST., PHILADELPHIA, PA.

Cochrane
FLOW METERS

This advertisement also appeared in:
NEW YORK TIMES
CLEVELAND PLAIN DEALER
CHICAGO DAILY NEWS
DETROIT FREE PRESS
WASHINGTON POST

You Expected to Read This NEXT YEAR!

Industry after industry is beating its promise as America's war production sets new world's records . . . Management, labor, W. P. B., Army, Navy, the Maritime Commission and other government departments are cooperating to make next year's headlines come true THIS year.

In World War I, the Kaiser feared American manpower. In World War II, Hitler is even more fearful of our rapid transition from peace to war production. . . . He has reason to be afraid.

Printing press factories are exceeding quotas on anti-aircraft gun parts.

Spark plug manufacturers are setting new speed records in machine gun production.

The heavy-transportation industry is making giant chassis for big guns at a faster rate than all the Axis powers combined.

In this industry, men who used to make locomotives and tractors are changing "Too Little and too Late" to read "Too Much and too Soon," from the enemy's viewpoint.

Starting just a few months ago, with a bale of blueprints and a knowledge of how to build such things as road-scrapers, power-shovels and trucks, the heavy-transportation industry is turning out mobile artillery that will shake the earth in more than a literal sense.

• • •

The story of how this industry joined the army carries a significance which should be understood and remembered.

The significance is that America has solved the problem of exchanging production techniques between specialized industries. This process went on unnoticed in peacetime. War gave it prominence.

OVER

▶When the bales of blueprints were first delivered, and the heavy-transportation industry started on its job of producing prime-movers and chassis for big guns in quantity, new production techniques were needed in a hurry.

▶Here are some of the questions that arose:

"How do you weld such heavy sub-assemblies?"

"What welding fixtures will handle these parts so that our workmen can always weld down-hand?"

"How can we make these long, heavy welds and have sound metal from one end to the other?"

"What's the best technique for testing welded parts? Shall we x-ray, or use the magnaflux process?"

"What's the best way to support these welded assemblies for machining?"

That's just a few of the thousands of questions that arose in the minds of experienced men when they had to solve new problems.

They illustrate the fact that American production methods depend upon specialized techniques and machines.

Each man with such a problem knew that someone, somewhere, had solved his problem, or might solve it before he could work out his own answer.

Therefore he turned to the source of industrial information he had always used when he wanted to know what others were doing . . . his industrial magazine.

Ever since the Maginot Line was flanked, the Industrial Press of America has been helping rookie industries to become veterans in the battle of war production.

▶It doesn't do this by exhortation or command, but by answering thousands of specific questions.

Just as newspapers keep their war correspondents at the front, Industrial Magazines keep their "war-production-correspondents" in the plants where weapons and equipment are made. McGraw-Hill editors are mobilized for war as literally as though they were firing weapons instead of helping to produce them. More than 90% of the time of McGraw-Hill's 153 editors and 725 engineer-correspondents is devoted either to visiting war-production plants (to study production techniques) or in writing "war stories" on how production problems were solved.

"Know-how" is the secret of the amazing records now being made by American Industry. And "know-how" comes from thousands of "little facts" like this:

Information on tool shapes for cutting the harder steels of war is vital literature to the engineer, designer or production man with the particular problem of cutting those steels confronting him.

The industrial editor does not work alone in giving vital information to men on the production line. In much the same way, manufacturers are war-converting their industrial advertising to show their readers how to use their products more effectively. For instance:

A business-paper advertisement showing how to make old taps and dies last longer has no glamour for anyone but the man who must rush production with an inadequate supply of new ones. To him it has enough "oomph" to be clipped and placed on his office wall.

To the casual observer, the Industrial Press is about as exciting as the rows of wires that stretch along every road and railway. . . . The simile is very apt. Both exist solely for the interchange of ideas. Both are typically American in the extent to which they have been developed and applied to the whole economy. . . . *This advertisement published by the McGraw-Hill Network of Industrial Communication.*

• • •

THE McGRAW-HILL NETWORK

23 PUBLICATIONS WHICH HELP MORE THAN 1,000,000 EXECUTIVES, DESIGNERS AND PRODUCTION MEN TO EXCHANGE IDEAS ON WAR-PRODUCTION PROBLEMS

American Machinist • Aviation • Bus Transportation • Business Week • Chemical & Metallurgical Engineering • Coal Age • Construction Methods • Electrical Contracting • Electrical Merchandising • Electrical West • Electrical World • Electronics Engineering & Mining Journal • E. & M. J. Metal and Mineral Markets • Engineering News Record • Factory Management & Maintenance • Food Industries • Mill Supplies • Power • Product Engineering • Textile World • Transit Journal • Wholesaler's Salesman. Also publishers of thousands of books for technical and engineering schools and colleges, as well as for general business use.

McGRAW-HILL PUBLISHING COMPANY, INC.
330 WEST 42nd STREET, NEW YORK

A Check List for Wartime Transformer Buyers

Get these 5 Pyranol features and you are sure of reliable service

1. High emergency-overload capacity. The heat storage capacity of Pyranol makes Pyranol transformers ideal for emergency overloads.

2. Stamina to withstand voltage surges. High dielectric strength (inherent in liquid-filled transformers) is an extra safeguard against damage from voltage surges due to lightning or switching operations.

3. Noninflammability. You can't burn Pyranol. No Pyranol transformer has burned, or contributed to a fire. This record, covering 10 years of operating experience, fully justifies the recognition accorded Pyranol transformers by the National Electrical Code.

4. Virtual freedom from maintenance. The efficiency and life of Pyranol transformers do not depend on frequent cleanings and other attention. Pyranol is nonoxidizing and nonsludging. Under normal operating conditions it will maintain its insulating properties through years of service.

5. Protection against moisture and dirt. The pressure-tight steel tank protects vital transformer parts against moisture, dirt, dust, abrasives, and other enemies of transformer reliability.

TRANSFORMER reliability is a big factor in continuity of power supply, and that's essential to maximum war production. Pyranol units have all the features—*plus*—that have made liquid-filled transformers the most nearly trouble-free electric apparatus in service today.

Save Vital Copper, Too

An actual example of savings: One new war plant saved 30,000 pounds of copper (because of shorter runs of heavy secondary conductor) by installing Pyranol transformers indoors at load centers.

Moreover, by locating transformers near the load, you get better voltage regulation and lower line losses.

For complete information on Pyranol transformers for your requirements, consult your G-E representative. Or, write General Electric, Schenectady, N. Y.

333-kva Pyranol transformer, incorporating Spirakore design. Rated 60 cycles, 2400/4160Y volts to 240/480 volts.

General Electric and its employees are proud of the Navy award of Excellence made to its Erie Works for the manufacture of naval ordnance

GENERAL ELECTRIC

402-43-5100

Meeting Steam Demands

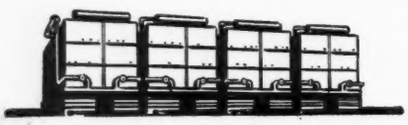
WITH PRESENT GENERATING EQUIPMENT

Under War Conditions

★

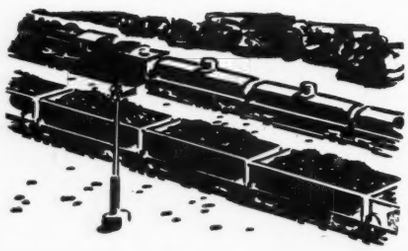
MEETING the increased wartime steam demand on your plant will require you to overcome many emergency difficulties. New steam generating equipment is hard to get, even with good priorities. Your force of skilled power plant operators may be dwindling. Transportation difficulties may produce local fuel shortages. Time is short! Here are things you can do.

STEAM GENERATION



OPTIMUM CAPACITY: To squeeze every possible pound of steam from your present steam generating units you must take full advantage of their "built-in" efficiency. To do this, fuel must be supplied in the correct amount to carry the load, fuel and air must be in the correct amount and ratio for best combustion, furnace draft correct for best furnace operation, water level constant, and so on.

Republic instruments and controls help you to do this by co-ordinating all factors in boiler operation and maintaining test efficiency 24 hr. a day, 7 days a week.



FUEL ECONOMY: Available fuel must be burned with maximum efficiency, so that only the very minimum of fuel need be hauled to a given location. Also, efficient combustion decreases boiler and furnace maintenance, thus minimizing fabrication and haulage of repair materials.

Republic boiler controls, by maintaining correct fuel-air ratio, especially in multi-fuel firing, and by providing for variations in fuel characteristics and other operating factors, aid in maintaining best combustion economy.

★

REDUCE OUTAGES: Correct boiler operation reduces outages to the bare minimum. When all factors are correctly maintained, fuel and air supply equipment operates at designed conditions, furnace wall troubles and slagging of boiler tubes are at a minimum, heat absorbing surfaces do their job correctly. Thus excessive troubles with any one factor cannot arise so suddenly as to require a major shut-down for extensive repairs.

Republic boiler controls keep all factors in step and thus maintain constant steam pressure, maximum combustion efficiency, best furnace conditions. Republic draft gages, flow meters, thermometers, etc., check the condition of boiler baffles, performance of heat absorbing or heat transferring surfaces and the like and help prevent serious maintenance outages.

★

SKILLED OPERATORS: Maximum efficiency must be maintained even if your plant is undermanned. A given operator must supervise more equipment, must give attention to more factors, must make more adjustments—and must aid in training inexperienced men.

Republic boiler controls, by performing routine repetitive adjustments, and Republic instruments, by recording and indicating the results, stretch the skill of operators.

EQUIPMENT • FACILITIES • PERSONNEL & EXPERIENCE
REPUBLIC INSTRUMENTS AND CONTROLS

SAFETY: Safe operation is always important but it is doubly so under present conditions. Safety of equipment means safety of operators as well, precludes major outages and costly repairs that use up valuable time and materials. Moreover, if new men are being trained, there may be unusual conditions of strain, when both operators and equipment are working at maximum capacity. Hence close control of equipment is vital to prevent a chain of events from starting.

Republic boiler controls and instruments, by co-ordinating all operating factors, prevent the chain-of-events type of trouble that may lead to serious shutdowns.

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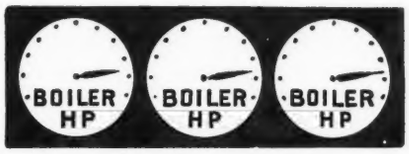
LOAD DISTRIBUTION: Since the load conditions in every plant and the characteristics of various types and makes of steam generating equipment and auxiliaries are dif-



ferent, some means of adjusting load distribution among units is needed to get optimum capacity and efficiency of the assembly. This is particularly true when more steam must be squeezed from the existing plant, for the maximum capacity point may not be the point of maximum efficiency and these will vary for different units. Thus various combinations are usually necessary.

Correct load distribution among units is determined by proper use of Republic instruments and is automatically maintained as desired by Republic boiler controls.

STEAM DISTRIBUTION

TROUBLE PREVENTION: The time to locate potential trouble spots is before they develop to a point

where they require extensive repairs and thereby interfere with production.

Republic instruments are invaluable in spotting such potential trouble spots before they develop.

★

STEAM WASTE: If the products of the power plant are not utilized economically, the load demand will be excessive, no matter how efficiently the power plant is operated. It should be realized that for every pound of steam wasted and for each extra gallon of water pumped, a corresponding amount of fuel had to be consumed in the boiler room. The maximum effective generating capacity is secured only when the boiler room is operated efficiently and its products used economically.

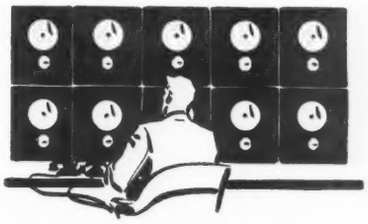
Republic flow meters installed on main distribution lines will immediately center attention on the department or unit using excessive amounts of steam.

★

PROCESS EFFICIENCY: To eliminate steam wastes and to maintain highest efficiency, it is necessary to establish criteria for gaging the individual needs of the various steam consuming departments or units and a means for checking their daily performance.

Republic meters will provide a continuous record of the amount of steam being consumed by each department or unit, when the peak demands occur, the total amount used, etc.

LOAD DISPATCHING: One of the most effective methods of insuring highest economy in the use of steam by industrial processes is by load dispatching, as practiced in many plants. This requires a centralized installation of instruments, where a load dispatcher can determine easily and quickly what the various processes are consuming, can schedule future pro-



cedures and co-ordinate steam consumption with steam production.

Republic electrical remote reading flow meters and other instruments are ideal for such centralized metering and load dispatching systems.

★

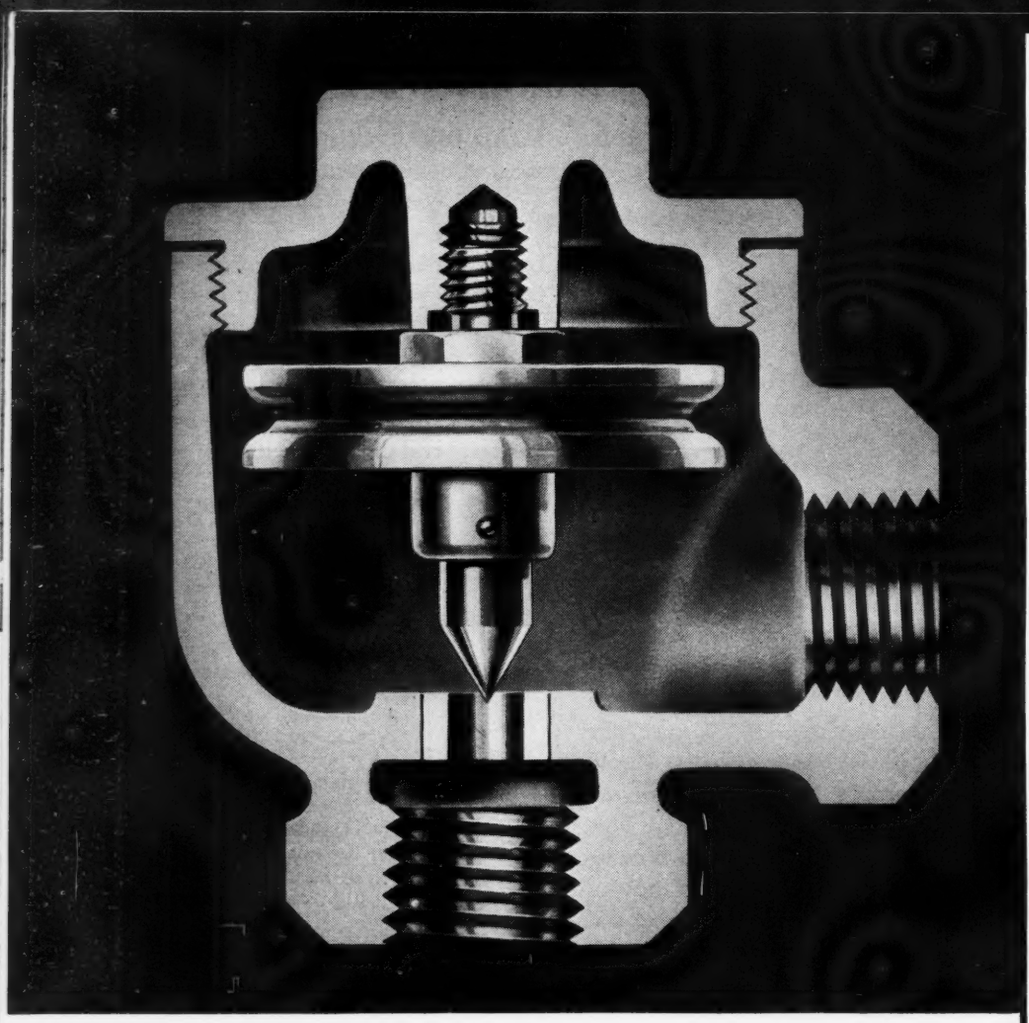
SAVING TIME

New steam generating equipment to produce all the steam you need may not be available to you for months. Yet Republic instruments and controls, employing relatively insignificant amounts of strategic materials are available in a relatively short time. And with these instruments and controls, by some or all of the methods outlined above, you may be able to increase your steam generation just enough to get it over the peak

Republic engineers will be glad to consult with you on the methods by which Republic equipment can help you solve your urgent wartime problems. Your request for this cooperation will involve no obligation on your part. Write to us today.

Republic Flow Meters Co.

2222 Diversey Parkway • Chicago, Illinois



Webster 702HF Radiator Trap.

To Save Critical Materials

"Old Ironsides"

It took months of planning . . . But, Webster Engineers are ready with the "Old Ironsides" line of radiator traps and valves conforming with the simplification program of the War Production Board. Cast iron bodies and bonnets. Female inlet and outlet connections. Three sizes of traps—½" for 200 sq. ft.; ¾" for 400 sq. ft.; ¾" for 700 sq. ft. Two sizes of valves—¾" and 1", both in angle body—with wheel handle standard; with lockshield handle for institutions. The traps employ the time-tested Webster thermostatic element, a double diaphragm of phosphor bronze fully compensated for pressure. The valves use the proven Webster mechanism, fully meeting the specification for spring-retained packing . . . The "Old Ironsides" line uses the minimum of critical materials; saves machine-tool hours for direct war work; keeps steam available for heating war production plants, Army hospitals, etc. "Old Ironsides" traps and valves will be available on appropriate priority.

Essential repairs for existing Webster System installations are available to our customers on A-10 priority, under provisions of Emergency Plumbing and Heating Repair Order P-84 of the War Production Board. Orders should be limited to actual repair needs.

WARREN WEBSTER & COMPANY
CAMDEN, N. J., EST. 1888, PIONEERS OF VACUUM STEAM HEATING

LEAN, savage warbirds . . .

60 thousand in 1942 . . .

125 thousand in 1943 . . .

That is America's promise to the Victory Program—and America is going to beat that promise.

It calls for new construction at record-breaking speeds . . . mile-long bomber plants, the largest in the world.

Heating problems presented by the new building program depend for their solution on the heating lessons learned in peace-time.

Fifty years of experience taught America the practical economy of Webster Systems of Steam Heating. Built around all the natural advantages of steam as a heating medium—flexibility, speed, safety. Used successfully in more than 75,000 buildings.

That is why architects, engineers and heating contractors working on war construction depend on Webster Systems of Steam Heating.

While Ordnance production has the first call on our facilities, we are working day and night to make sure that Webster Steam Heating Equipment is available for use wherever it will help the war effort.

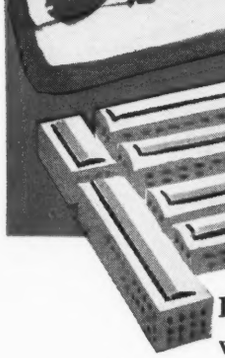
Let our experience serve you now.

Warren Webster & Company, Camden, N. J.
Representatives in 65 principal Cities

Webster
Steam Heating

This is one of a series of advertisements that will tell the public of the part that Webster Steam Heating and the Webster organization plays in the war effort . . . appearing regularly in leading business, industrial, engineering and technical publications.

Boilers CAN'T BREAK DOWN in Wartime



BOILERS *can't* break down in wartime . . . but they do!

And that's plenty reason why *you* should play safe and use the best feedwater protection you can get to protect *your* power plant equipment.

Allis-Chalmers offers you a complete Feedwater Service . . . designed to help you get *maximum* and *continuous* power.

For over 60 years, Allis-Chalmers has been a leading manufacturer of power plant equipment — solving power plant problems and helping to increase power plant efficiencies. It's this background (plus 15 years providing feedwater service to industry) that makes this service so important and so valuable to you today.

Remember — Allis-Chalmers Feedwater Service is *practical!* Trained Allis-Chalmers Service Engineers study *your* problem in *your* plant. They stay with the problem until it is solved . . . pay frequent calls to make sure the problem remains solved.

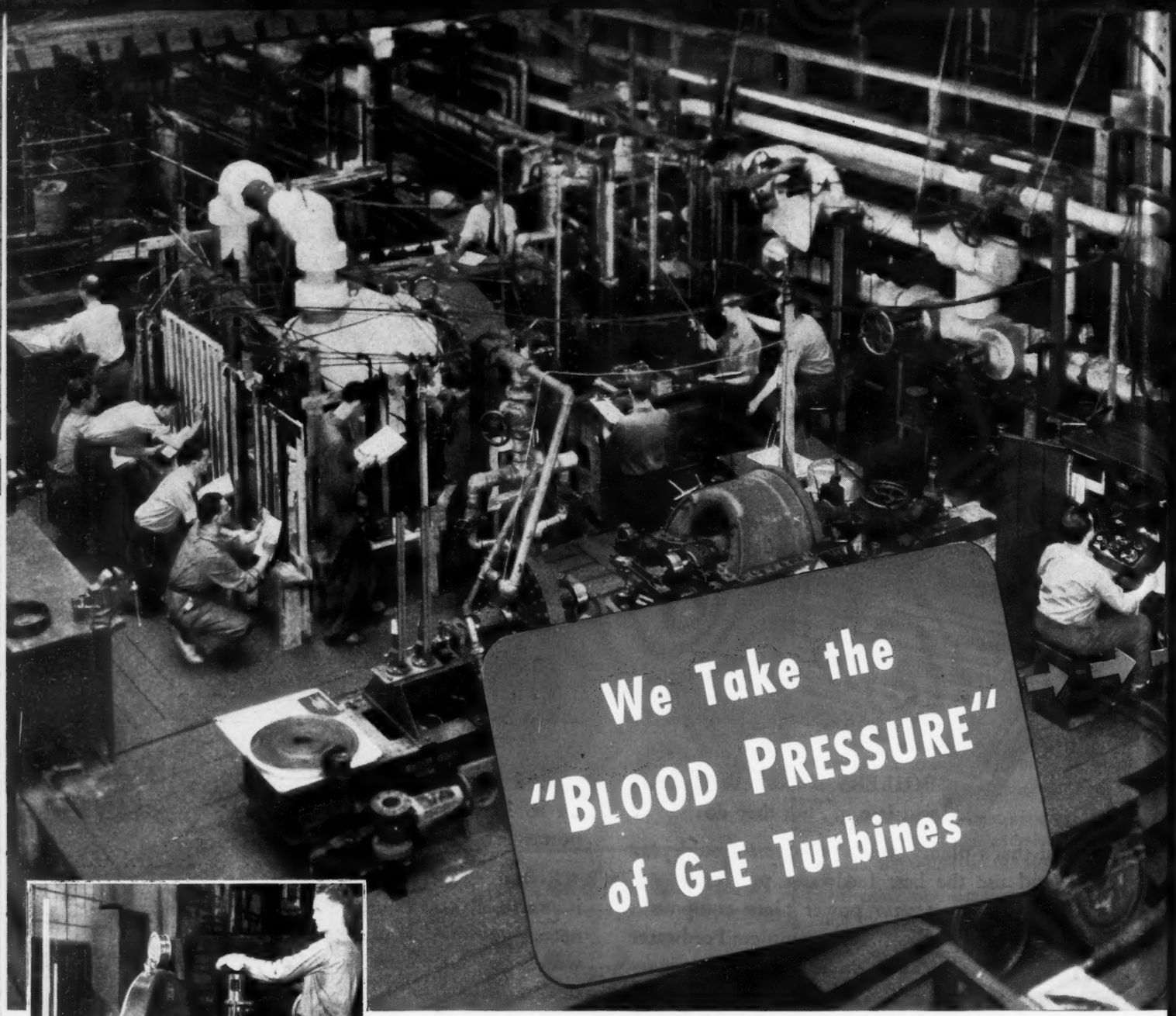
Just as Uncle Sam needs your power capacity . . . so you need Allis-Chalmers Feedwater Service to protect that capacity. Write — today — for the complete story. A 1478

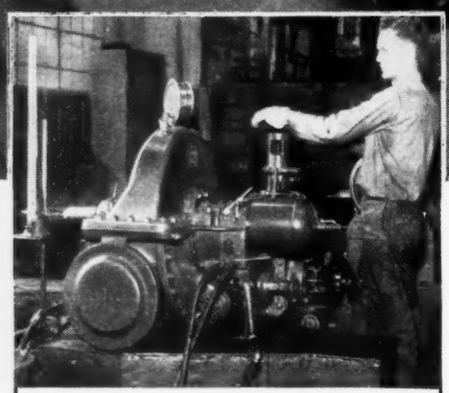
FIRST STEP — WHEN YOU SUBmit your feedwater problems to us — is for a trained Allis-Chalmers Feedwater Service Engineer to visit your plant . . . analyze your conditions . . . take samples for preliminary study.

SAMPLES ARE THEN ANALYZED in the Allis-Chalmers laboratories . . . specific treatments suggested to prevent scale, corrosion, carryover, embrittlement, and all other feedwater ills, with provisions for changing conditions.

ALLIS-CHALMERS
MILWAUKEE · WISCONSIN

VITAL TO SUCCESS OF SERVICE — the Field Service Engineer in your territory makes frequent calls . . . inspects equipment . . . makes repeated water and steam tests...gives you complete feedwater protection at all times.





Even the smaller Type D mechanical-drive turbines are given a complete operating test under steam to provide advance proof of their performance. This running trial permits adjustment of the speed governor, setting of the overspeed trip, checking smoothness of rotation, and testing packing glands and steam joints. It's attention to these details that reduces the time from shipping crate to machine in operation.

TAKING the "blood pressure" of a new multistage turbine sounds fairly simple. It is—if you have enough room, men, steam, equipment, and time. First, you set up the turbine just as it will be installed in service and make all steam and oil connections. Then you attach more than a score of manometers, thermocouples, and gages; and load up the turbine with a water brake. It takes 14 men to do the job accurately, because inlet pressure, speed, brake force, and exhaust pressure must be held steady while simultaneous readings are taken.

When you finish you have pages of test data that the engineers in the Steam Design Section translate in terms of nozzle, bucket, and turbine efficiencies. Each reading and curve gives valuable knowledge of the design under test.

This is just one of the many tests that are being made continually in G-E turbine workshops—tests that assure utilities, industrials, and ourselves that a turbine-generator with the G-E nameplate will deliver the performance for which it was designed. What's more, these tests are always adding to the fund of knowledge that has enabled G-E engineers to build more reliable, more efficient turbines year after year.

General Electric and its employees are proud of the Navy award of Excellence made to its Erie Works for the manufacture of naval ordnance.

2500-kw, 60-cycle turbine-generator installed in 1928

In 12 Years of Unfailing Operation

95,513,050 Kw-hr Generated — $535 for Two Routine Inspections

TROUBLE took a holiday for 12 years in a Kansas power plant—thanks to a 2500-kw G-E turbine generator. The unit was installed in 1928 to generate low-cost, dependable power. Twelve years later, when a new 4000-kw G-E turbine took over the load, the log book told a performance story of economical, reliable operation—95,513,050 kw-hr generated; only $535 spent for maintenance. The inspection record indicated that the only renewal parts necessary were a supply of slip-ring brushes, one ring of steam-seal carbon packing, and seats for the pressure control valve on the auxiliary oil pump. "The turbine never failed to perform its duty as the main generating unit in our plant," said Supt. W. O. Meyers, "and we are expecting equally as good service from the new 4000-kw unit."

General Electric turbine-generators are noted for their superb performance and long life. Right now, when power-hungry industry is putting the problem of producing more power squarely up to you, and the delivery of new units is being made only to war-production plants, trouble-free performance is doubly important.

In these days it is especially desirable that a periodic schedule of inspection and maintenance be followed. When assistance is needed, we urge you to take advantage of our field service. Your nearest G-E office will help you make sure you are getting the most out of every G-E machine in your plant. *General Electric, Schenectady, New York.*

GENERAL ELECTRIC

258-5-410

How to get *Longer Life + Greater Service* from the refractory linings *You Now Have*

Refractory maintenance coating reconditions linings by building up eroded or burned refractory surfaces to their original thickness. Old walls can be kept in constant repair.

Today when plants must operate at capacity and conservation of every material essential to the war effort is imperative —GREENCOTE offers you an economical means of getting longer life and service from the refractory linings you already have.

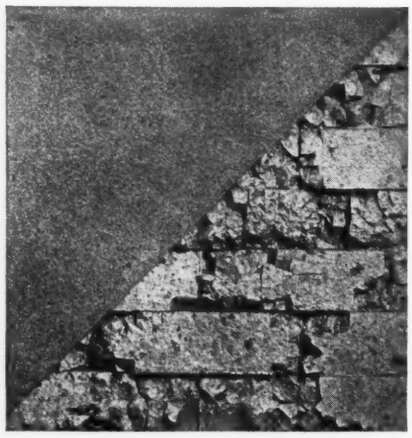
Spalled or burned sections of furnace walls can be made as serviceable as the rest of the lining by applying GREENCOTE. Repeated applications of this amazing maintenance coating over the entire refractory lining can greatly lengthen the overall life of the original setting. Frequent and costly relining of furnaces often made necessary by wear on small sections can be eliminated. Its use is simple and inexpensive.

What is GREENCOTE? GREENCOTE is a refractory just like the lining of the furnace but possessing properties that make it possible to apply it as a coating to restore burned or worn away surfaces. It is as refractory as high heat duty fire brick and will adhere just as well to hot or cold, new or old refractory surfaces. Its high refractoriness makes it resistant to slag, erosion and spalling. GREENCOTE can be easily applied by troweling or spraying. Comes in 100-pound bags.

Free An interesting new folder tells more about GREENCOTE and how it is being used to recondition and maintain refractory linings in constant repair—at low cost. Fully illustrated with photographs of actual jobs. Write for your free copy today.

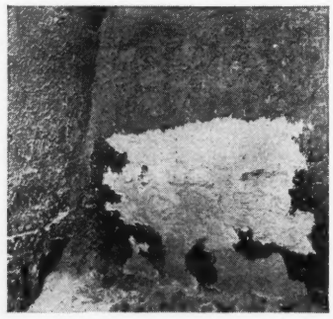
Conserve — Defense Comes First

To meet the needs of industry and national defense, the already increased production of our plant is being speeded. But we are working against an abnormal backlog of orders for fire brick. Delivery promises are often long. Naturally, our war effort comes first—so help yourself and your country by making every effort to get longer life from the refractory linings you have. The A. P. Green Co. manufactures many products, which are in stock for immediate shipment, to meet such needs. Our Refractory Engineers are always available to work with you and help you devise means of getting longer life and greater service from what you already have.

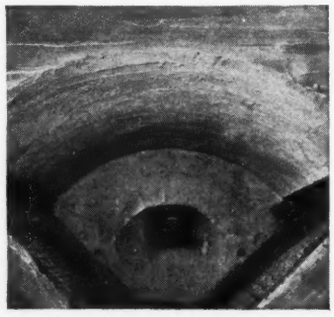


APPLICATION OF GREENCOTE over spalled brick make it possible to build the lining back to its original thickness.

In Dozens of Different Types of Applications the wide range of usefulness of GREENCOTE is being demonstrated.



LOCALIZED "HOT-SPOTS" where erosion occurs can be reconditioned with GREENCOTE and costly repairing of the furnace eliminated.



PERIODIC COATINGS OF GREENCOTE prolong the life of refractory arches and often eliminate the necessity of costly repairs.

Quick Delivery — Local Stocks & Service

Warehouse stocks are located near you for prompt delivery. Look in the classified section of your local telephone directory for the name of your nearest A. P. Green representative.

A. P. Green
FIRE BRICK COMPANY
MEXICO, MISSOURI

REFRACTORY PRODUCTS FOR EVERY INDUSTRIAL USE

DO YOU KNOW THIS — ABOUT WATER-COOLED STOKERS?

WATER-COOLED wins in the Mid-West

A central city mid-western plant, to assure minimum stack discharge nuisance, finally selected a Taylor Water-Cooled Stoker for its reliability, flexibility and freedom from fly ash.

Using this Equipment

A 600 H.P. Straight Tube Boiler with Economizer and Vertical Side and Rear Water Walls Maximum Capacity—75,000# Steam Per Hour.

Taylor Water-Cooled Stoker, 7 Retorts 37PC7; 181.7 sq. ft. driven with constant speed motor and Reeves Transmission.

And Coal of this Analysis...

	APPROXIMATE Moisture	Volatile	Fixed Carbon	Ash
Kansas—Raw 1.....	7.0	36.0	42.0	15.0
Raw 2.....	5.4	34.82	49.74	10.4
Washed 3.....	7.0	37.0	45.0	11.0
Occasional....	5.0	34.53	53.69	6.78

	ULTIMATE Sulphur	Carbon	Oxygen	BTU as Rec'd	Fusing Pt. of Ash Deg. F.
Kansas—Raw 1...	3.6	69	7.0	11,400	1975
Raw 2...	3.68	67	9.0	12,629	2280
Washed 3...	2.68	70	7.0	12,400	2150
Occasional..	4.20	54	6.8	13,250	—

They Obtained these Results

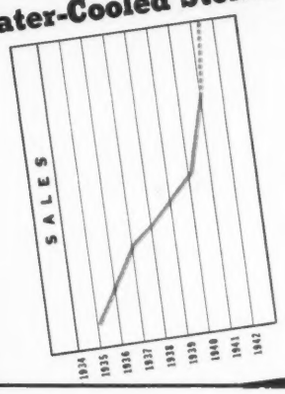
Period	April 22, '39 to December 31, '41 incl.
Total Steam Generated	579,921,000 lbs.
Total Coal Burned	63,228,145 lbs. (31,614 tons)
Aver. Evaporation (Lbs./Lb. Coal)	9.17
Aver. B.T.U. Coal As Fired	12,570
Aver. Operating Conditions	
Pressure	400 lbs. G.
Total Steam Temperature	695°F.
Feed Temperature to Economizer	218°F.
Combined Efficiency	85.4%
Cost of Material for Stoker Repairs	$369.10
Average Cost of Material per Ton of Coal Burned	$.0116

Improves Operation 3 Ways

Taylor Water-Cooled Stokers improve operation in over a dozen ways—most important by 1. Increasing reliability, 2. Increasing fuel flexibility, 3. Higher operating efficiency. Do you know how they are accomplished?

Factful information on the advantages, construction and installations of Taylor Water-Cooled Stokers is contained in a new booklet ready now.

What's behind the big rise in Taylor Water-Cooled Stoker sales?



Slowly, painstakingly developed for more than 15 years, Taylor Water-Cooled Stokers have suddenly shot upward in acceptance by leading power plant engineers. Let Catalog W (below) show you why.

They "asked a man who owned one" and this is how he replied...

Charge to the account of

WESTERN UNION

CHECK

ACCOUNTING INFORMATION

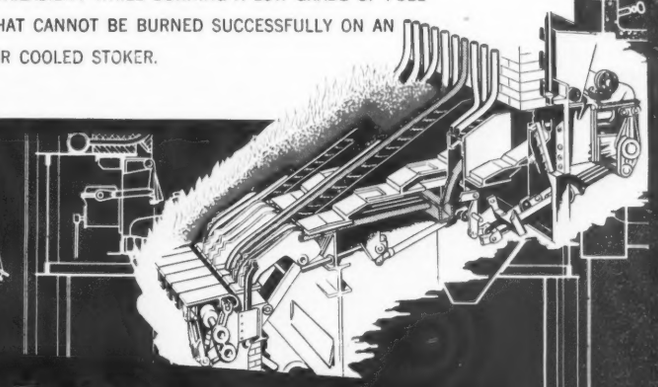
TIME FILED

R. B. WHITE, PRESIDENT — NEWCOMB CARLTON, CHAIRMAN OF THE BOARD — J. C. WILLEVER, FIRST VICE-PRESIDENT

Send the following message, subject to the terms on back hereof, which are hereby agreed to

NA169 43 NT 1 EXTRA 18

OUR WATER COOLED STOKER IS VERY RELIABLE AND FLEXIBLE WITH LOW MAINTENANCE AND HIGH AVAILABILITY WHILE BURNING A LOW GRADE OF FUEL THAT CANNOT BE BURNED SUCCESSFULLY ON AN AIR COOLED STOKER.



A-E-CO TAYLOR WATER-COOLED STOKER

A-E-CO TAYLOR WATER COOLED STOKER

AMERICAN ENGINEERING COMPANY

A-E-CO TAYLOR STOKERS • WATER WALLS • ASH HOPPERS • LO-HED HOISTS • MARINE DECK AUXILIARIES • HELE-SHAW FLUID POWER PUMPS

AMERICAN ENGINEERING COMPANY, 2400 Aramingo Ave., Phila., Pa.

Please send me your 8-page Catalog W on Taylor Water-Cooled Stokers, without obligation.

*Name*_____

*Company Name*_____

*Address*_____

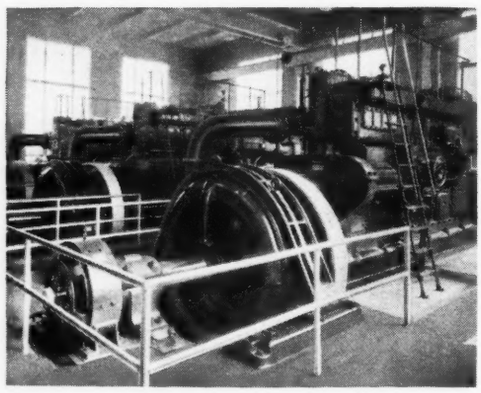
*City*_____ *State*_____

Here's PROOF of F-M Diesel

Municipal REPEAT ORDERS

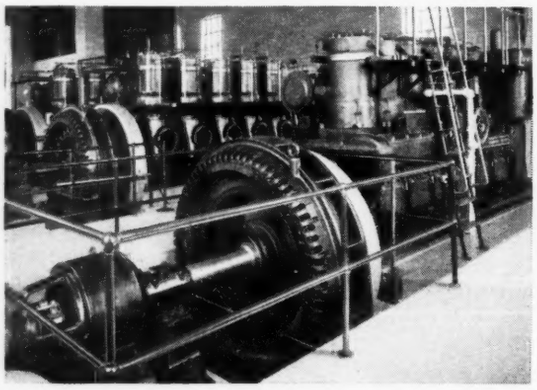
Rates Are Third Lowest in State

Only two cities in Illinois enjoy lower rates than Bloomington, yet the municipal power plant earned $26,670 in a recent, typical year. Major credit is given to the high efficiency and low overall operating cost of the city's three 750-hp. Fairbanks-Morse Diesel generators.



WHEN a manufacturer or a municipality buys its first Fairbanks-Morse Diesel, the decision is necessarily based largely on expectations. But when this purchase is followed by a *repeat order,* a really significant tribute has been paid. For the decision to buy another Diesel of the same make is based on first-hand experience . . . on actual performance under all conditions . . . often on long-time operating cost records.

So it is noteworthy that, in a recent, typical 16-month

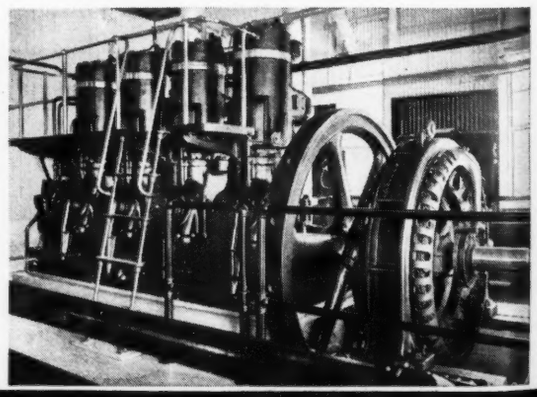


$16,985 Operating Profit Convinces Zeeland

Zeeland, Michigan, installed two 375-hp. Fairbanks-Morse Diesel generators in its new power and light plant late in 1937. So economically did these engines function that the first year's operating profit was $16,985! Meanwhile, low rates had resulted in a fourfold increase in power consumption. So, on the records of the first two, a third F-M Diesel was installed.

Still Efficient after 19 Years!

After 19, 18, and 13 years, respectively, of constant service, the three F-M Diesels in the Everglades, Florida, power plant still generate power dependably and economically. Fuel consumption is actually lower now than when the engines were new, because all three have been modernized — a money-saving possibility resulting from farsighted F-M design.



FAIRBANKS·

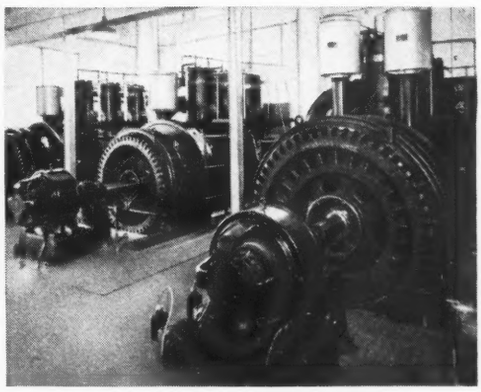
DIESEL ENGINES ELECTRICAL MACHINERY MAGNETOS RAILROAD EQUIPMENT WASHERS-IRONERS STOKERS

Performance... REPEAT ORDERS!

period, 80% (by horsepower) of all F-M Diesels sold were *repeat orders!* The stories of a few F-M Diesel repeat orders are summarized here.

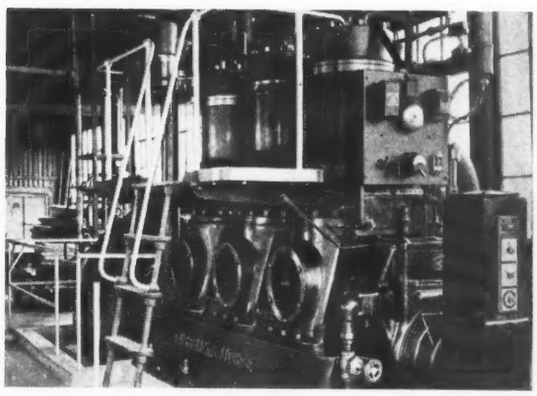
If you are considering installing or expanding a power plant, it may pay you well to investigate the reasons why F-M Diesels win so many repeat orders. Write Fairbanks, Morse & Co., Dept. F66, 600 S. Michigan Ave., Chicago, Ill. Branches and service stations throughout the United States and Canada.

Industrial REPEAT ORDERS



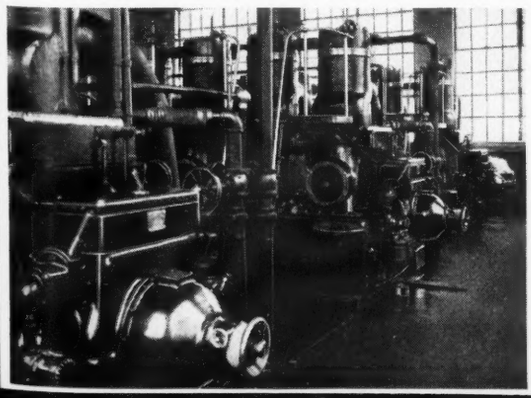
Five Repeat Orders in Ten Years

The Rockford (Illinois) Screw Products Co. bought its first F-M Diesel in 1932, soon expanded with a second, and now has *six* in constant service . . . a striking tribute. In a recent year more than 1,000,000 kw. hr. were generated at a fuel and lube oil cost of only $0.0055 per kw. hr.



Power Cost Cut ⅔ by F-M Diesels

Lyon, Conklin & Co., sheet metal fabricator in Baltimore, Md., credits its three Fairbanks-Morse Diesels with providing power at ⅓ the cost of buying it outside. Two of this firm's three Diesels have seen 17 years of service, with no repairs other than new piston rings. It was that performance record which dictated the purchase of a third F-M Diesel for expansion in 1939.



Diesels Save Flour Mill $17,000 per Year

After using steam power and purchased electric power, the Tennant and Hoyt Flour Mill, Lake City, Minnesota, installed two 350-hp. F-M Diesels in 1932, and promptly found power costs reduced from 7½c to 4½c per barrel of flour milled. In 1937, a 375-hp. F-M Diesel was added as the mill capacity was increased. Net savings, as compared with purchased power, now exceed $17,000 per year.

MORSE DIESELS

PUMPS MOTORS FAIRBANKS SCALES WATER SYSTEMS FARM EQUIPMENT AIR CONDITIONERS

Helpful "Staff Work"

IN THE BATTLE OF PRODUCTION

All over America, engineers and production men are converting plants to war needs. These men know they can... upon request... get helpful suggestions from us about ways to speed up the working of metals and alloys.

This helpful information has been mobilized into convenient charts, pamphlets and other printed pieces. These tools-in-type range from technical data for engineers to simplified reports on performance of alloys containing Nickel under specific operating conditions.

Here, also, are correlated latest reports from the field about selection, fabrication and uses of ferrous and non-ferrous Nickel Alloys.

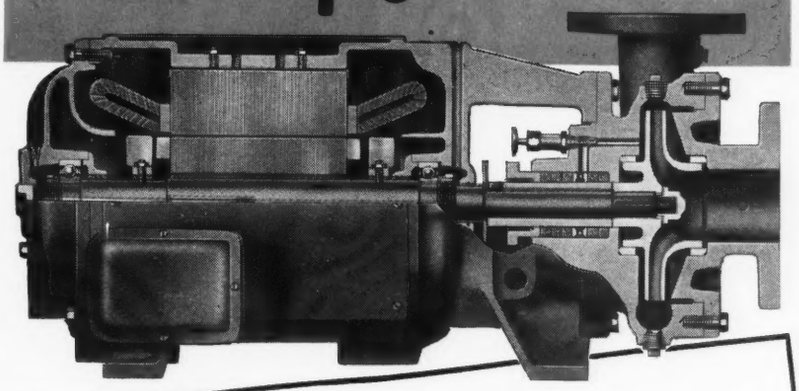
And, as further support for your battle of production, we offer personal assistance from members of our technical staff. With recent experience in many plants facing materials difficulties, these men become especially helpful. During wartime, Nickel... and information about Nickel... must go where it best serves the United Nations.

☆ ☆ *Nickel*

THE INTERNATIONAL NICKEL COMPANY, INC. 67 WALL STREET NEW YORK, N. Y.

FOR TRIPLE-SHIFT DUTY!

ALLIS-CHALMERS ELECTRIFUGAL PUMPS



New Allis-Chalmers "One Package" Pumps are 5-Way Winners in Giving You More Pumping Dependability!

THREE SHIFTS a day . . . efficient, dependable, economical operation every day of the week — that's what wartime industry expects of its pumping equipment.

And that's exactly the kind of service you get with the new Allis-Chalmers Electrifugal Pump . . . better in 5 important ways!

For with this new pump — compact construction with motor and pump on one shaft and in one housing saves you as much as 33% in space, cuts pump overhang as much as 40%. Unified "Tri-fit" design requires but three of the five section fits normally required . . . resulting in fewer parts to wear and more positive shaft alignment.

In addition — you get a new motor, completely splash-proof, 100% designed for pump drive . . . with indestructible rotor and distortionless stator.

Important too—these pumps are available to you in sizes from ½ hp to 25 hp (in most cases right out of stock) . . . at an actual saving to you in initial cost of up to 33%.

For complete information on this "one package" pump, call the engineer in the district office near you. Or write Allis-Chalmers, Milwaukee, Wisconsin.

A 1496

✓ Check These Great One-Package Features

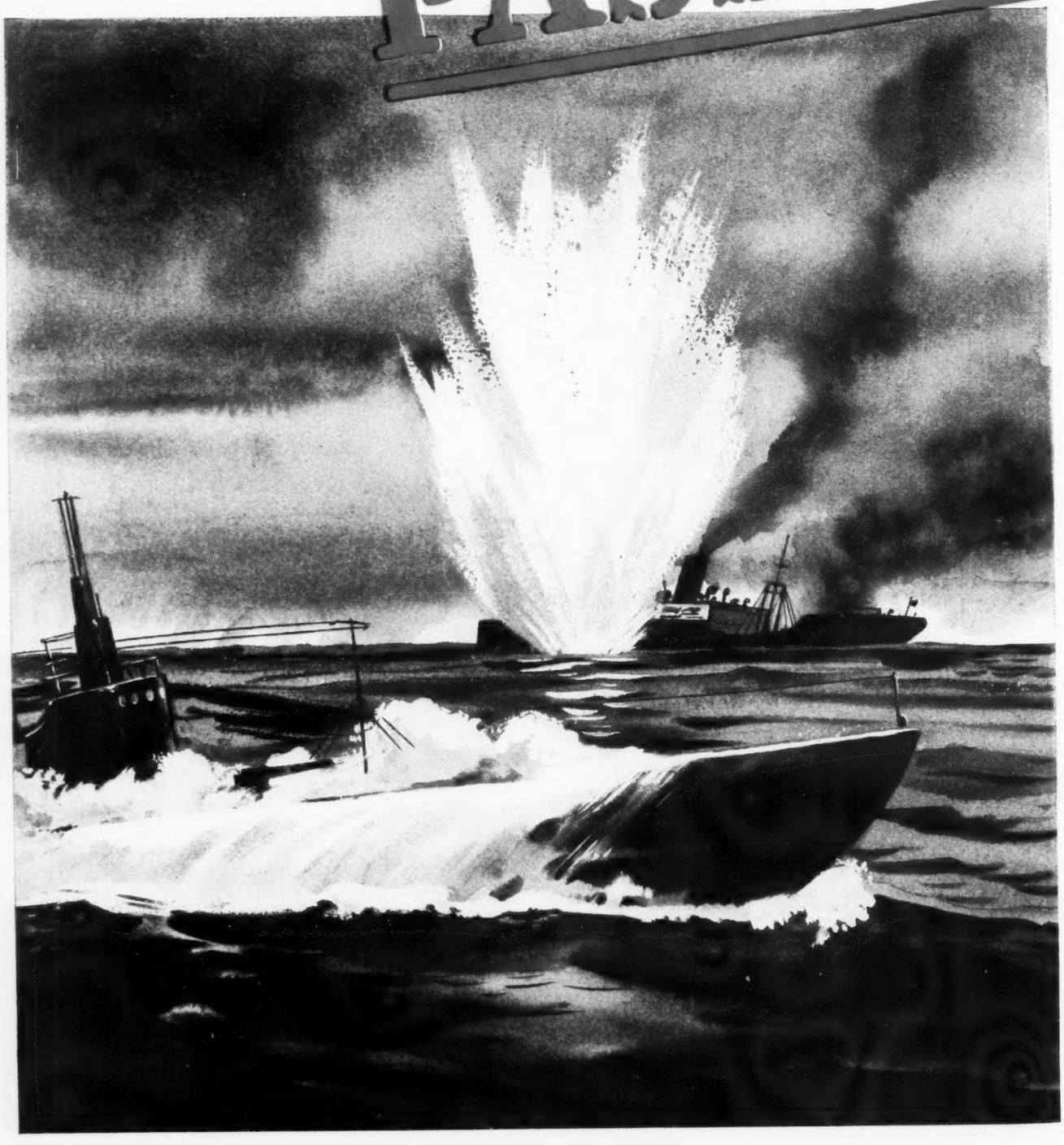
1. *Up to 33% Space Saved* with one frame, one solid driving shaft construction.
2. *Overhang Cut as Much as 40%.* Four solid supports assure precision balance . . . ease strain on vital parts.
3. *New Tri-Fit Design* eliminates 2 section fits for more positive shaft alignment, wearless and vibration-free performance.
4. *Splash-Proof* Motor standard equipment . . . 100% designed for pumping.
5. *Easy-to-Get-at* Casing simplifies stuffing box and waterseal gland inspection.

Allis-Chalmers Pumps Can Cut Your Pumping Costs

ALLIS-CHALMERS
MILWAUKEE · WISCONSIN

HERE'S ONE FACT ABOUT OUR SUBS

PASSED



BY CENSOR

U. S. submarines use RPM DELO— a lubricating oil for Diesels unequaled in any other country in the world.

The enemy can take this down in his notebook. He can even sneak a camera shot of it. But it won't do him any good.

Because with all the blueprints and photographs in the world he can't copy the calm, hard-headed skill and heroism of the men in our Navy submarines. He can't duplicate the free spirit and unhampered initiative that invented the submarine—and is going to keep on inventing.

And we're proud to say, for our part, that with all the oil in Asia neither he nor anybody else has anything approaching RPM DELO. And this is another thing he cannot copy.

If, at crucial moments, his rings stick and parts freeze—and he has to put in for overhauls many times as often—it will give us great satisfaction to say: . . . *"So sorry!"*

U. S. Navy submarines use RPM DELO and we're here to say that Uncle Sam has first call—and will continue to have first call—on every precious drop he can use.

Standard Oil Company of California

ORDER RPM DELO FOR YOUR DIESELS

RPM DELO is marketed under the following names:

RPM DELO · Caltex RPM DELO · Kyso RPM DELO
Signal RPM DELO · Sohio RPM DELO
Imperial-RPM DELO
CONCENTRATE

Ask your Diesel engine manufacturer or distributor for the RPM DELO supplier in your vicinity.

LET'S GO! U.S.A. KEEP 'EM FLYING!

RPM DELO
REG. TRADE MARK
DIESEL ENGINE LUBRICATING OIL

Keep the Industrial Fires Burning

WITH QUIGLEY REFRACTORY PRODUCTS

Maximum industrial production . . . to meet urgent war requirements . . . is demanded of American Industry. Industrial furnaces of all kinds must produce far greater volume than ever before. Quigley Refractory and Insulating Products for construction and maintenance of industrial furnaces are doing their part. From the steel mills of Pittsburgh to the oil fields of Texas, from the aircraft plants of California to the shipbuilding plants of New Jersey, Quigley Refractory Products are saving time, trouble, money — and boosting production.

HYTEMPITE—plastic, air-setting refractory cement. "The World's Standard High Temperature Cement."

Q-CHROME—neutral base refractory cement.

Q-CHROMASTIC — plastic, neutral super-refractory surfacing material.

FIRE BRICK—Missouri, Pennsylvania, New Jersey

CAST-REFRACT—standard castable refractory.

HEARTH-CRETE—patented chrome-base castable refractory; slag and abrasion resistant.

MONO-LINE—plastic fire-brick.

INSULAG—refractory lagging insulation.

REFRACTORY GUN—for quick repairs, hot patching, surfacing, and baffle maintenance.

INSULCRETE—insulating refractory concrete.

INSULBRIX—insulating fire brick.

INSULBLOX—refractory block insulation.

PRECAST PANELS—for construction of industrial furnace structures.

ACID PROOF CEMENT—plastic, ready mixed, acid proof and heat resisting cement.

INSULCLAD—plastic, refractory surface coating.

INSULBOND—high refractory bonding mortar.

Quigley Refractory and Insulating Products have built a reputation for highest quality, dependable performance, lower maintenance and construction costs, and lasting service.

WRITE FOR DESCRIPTIVE BULLETINS.

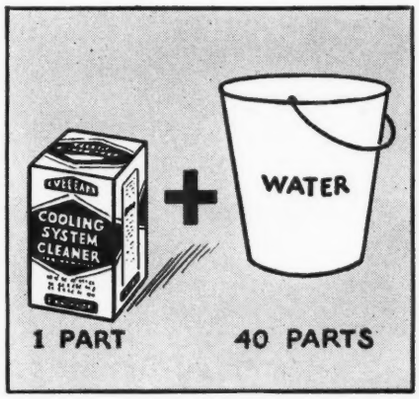
QUIGLEY COMPANY, INC.

Makers of HYTEMPITE, "The World's Standard High Temperature Cement"

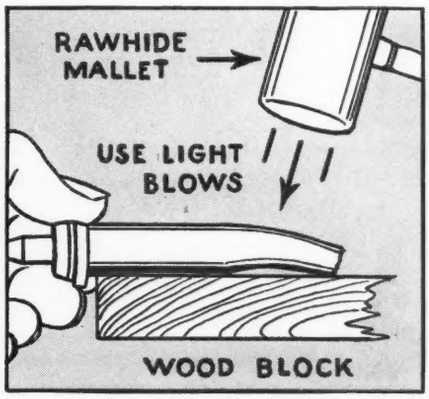
56 WEST 45th STREET NEW YORK, N. Y.

Distributors with Stocks and Service in Important Industrial Centers Throughout the United States, Canada and Foreign Countries.

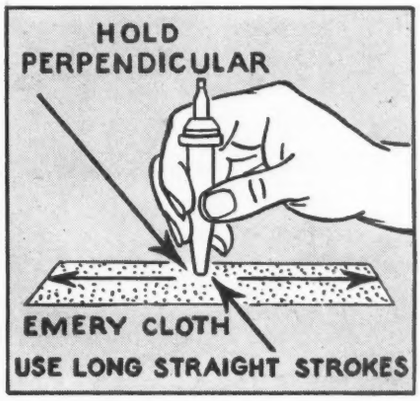
How to Recondition Oxy-Acetylene Hand-Cutting Nozzles



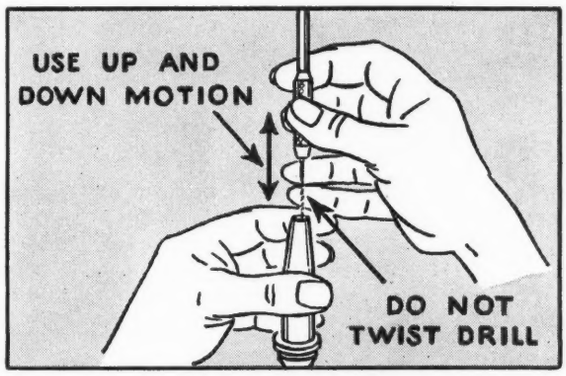
1. *Immerse the nozzle overnight* in a solution of 1 part "Eveready" automobile cooling system cleaning compound and 40 parts of water. Do not use the conditioner packed with the compound.



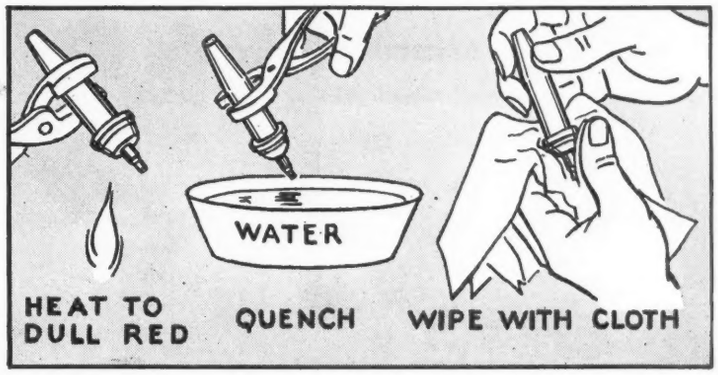
2. *If the nozzle is bent,* it usually can be straightened satisfactorily. To do this, place it on a wood block and straighten it by repeated light blows of a rawhide mallet. Do not use heavy blows.



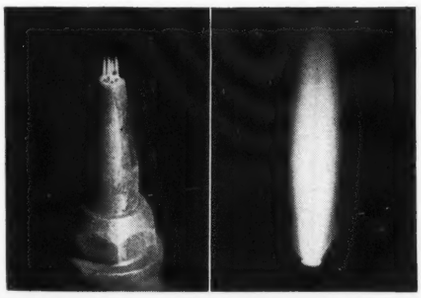
3. *Square Up the flame end* of the nozzle by rubbing it on Aloxite or emery cloth. Orifices must be round with sharp edges and no burrs. As much as ¼ in. can be removed from the nozzle end.



4. *To clear gas passages,* select the correct size drill—as specified in the blowpipe instruction book—and proceed as illustrated. Work the drill up and down carefully—do not twist it. If the drill does not enter the orifice easily, do not force it — start with smaller sizes. The last inch of the gas passages must be clean, to size, *and not bell-mouthed.*



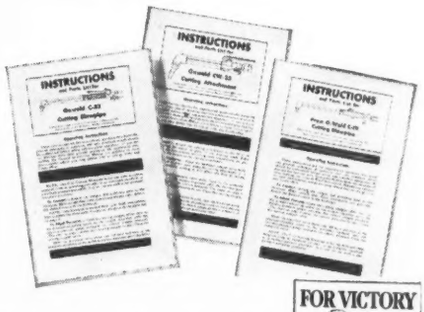
5. *To clean the nozzle seats,* heat up the seat end below the nozzle nut ring to a dull red heat—then quench in water. This loosens the scale so that it can be wiped off with a damp cloth. The heating softens the nozzle seats somewhat so that when connected to the blowpipe, they are burnished and dressed by the harder seating surfaces in the blowpipe head. If there are dents or nicks which are not eliminated by this procedure, the nozzle should be discarded.



6. *Test the flames.* Preheat flames should be uniform and the cutting oxygen jet symmetrical. Short preheat flames indicate restrictions in the gas passages. If the flames snap out when the valves are closed, the orifices are bell-mouthed.

Send for Instructions

If duplicate copies of the instruction booklets furnished with your Oxweld, Purox, or Prest-O-Weld apparatus will be helpful to you, we will send whatever copies you require. Be sure to specify the type of equipment you have. You may also obtain any required quantity of reprints of this advertisement.



THE LINDE AIR PRODUCTS COMPANY

Unit of Union Carbide and Carbon Corporation

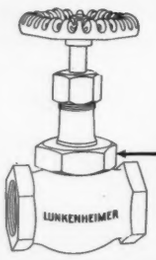
30 East 42nd St., New York, N. Y. UCC Offices in Principal Cities

In Canada: Dominion Oxygen Company, Limited, Toronto

LINDE OXYGEN . . . PREST-O-LITE ACETYLENE . . . UNION CARBIDE
OXWELD, PUROX, PREST-O-WELD APPARATUS . . . OXWELD SUPPLIES

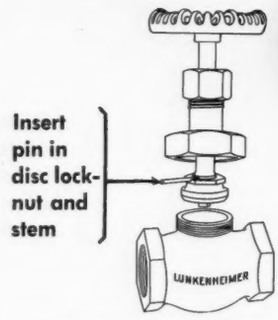
The words "Linde," "Prest-O-Lite," "Union," "Oxweld," "Purox," and "Prest-O-Weld" are trade-marks of Units of Union Carbide and Carbon Corporation.

INSTRUCTIONS FOR REGRINDING

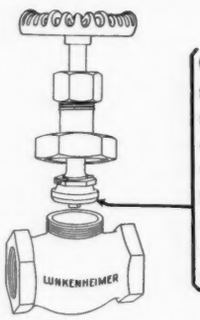


1st OPERATION

Remove trimmings from valve body.

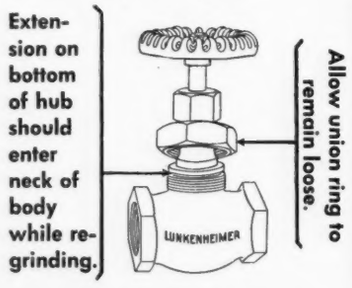


2nd OPERATION



3rd OPERATION

Replace trimmings in body and regrind.

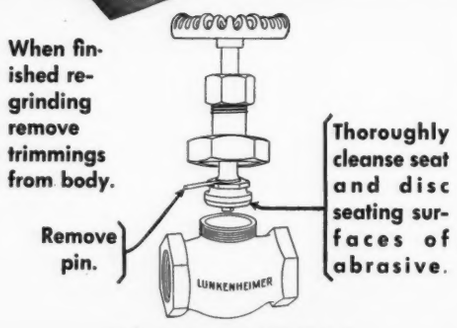


4th OPERATION

Lift Check
Fig. 414—200 lb. S. P.
Fig. 413—300 lb. S. P.

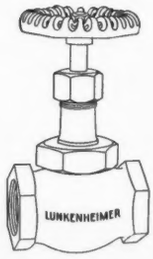
Swing Check
Fig. 554—200 lb. S. P.
Fig. 624—300 lb. S. P.

Globe
Fig. 407—200 lb. S. P.
Fig. 409—300 lb. S. P.


When fin-ished re-grinding remove trimmings from body.
Remove pin.
Thoroughly cleanse seat and disc seating sur-faces of abrasive.
LUNKENHEIMER

5th OPERATION

Assemble



6th OPERATION

LUNKENHEIMER VA

IT'S EASY TO REGRIND THESE LUNKENHEIMER VALVES

with a few minutes effort they can be made as good as new . . .

Valve regrinding is really a simple operation—it can be done so easily and quickly without taking the valve from the line.

And in this critical period when savings in maintenance time mean so much toward total production—even the time saved in the regrinding operation over valve replacement is of vital importance.

All parts of Lunkenheimer Regrinding Valves are renewable. Having a few parts available in stock for an emergency can also save much valuable time.

ESTABLISHED 1862

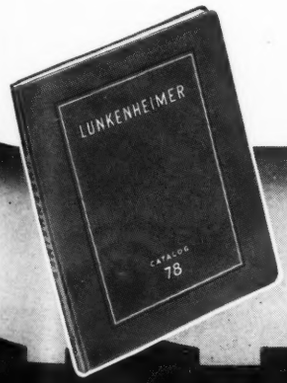
THE LUNKENHEIMER CO.

"QUALITY"

CINCINNATI, OHIO. U. S. A.

NEW YORK CHICAGO
BOSTON PHILADELPHIA

EXPORT DEPT. 318-322 HUDSON ST., NEW YORK



Your Lunkenheimer distributor has a supply of Catalog 78. Ask for your copy.

Since virtually all materials used in the manufacture of valves are on the list of critical materials, valve users are urged to furnish the highest possible preference ratings on their orders. This will be of mutual helpfulness.

VALVES BOILER MOUNTINGS LUBRICATING DEVICES

3-78-42

MORE POWER from your ...with IRON

A Typical Example of Iron Fireman P.S. Performance

Boiler Output Increased 41%... Evaporation per lb. of Coal Increased 21%... Steam Costs Reduced 30% in Georgia Plant

JOHN M. CLARK
President, Georgia Vitrified Brick & Clay Company

MORE steam, at one-third lower fuel cost, is being produced in the boiler plant of the Georgia Vitrified Brick and Clay Company, Campania, Ga., by Iron Fireman Pneumatic Spreader stoker firing.

Three years ago one Iron Fireman P.S. Stoker was installed to fire two boilers.

The boilers are H.R.T. welded type, with 1470 square feet of heating surface.

Boiler tests made before and after the modernization of the plant included these highlights:

Evaporation per pound of coal increased 21%.

Maximum horsepower developed increased from 425 h.p. to 600 h.p., or 41%.

Cost of 1,000 pounds of steam reduced from 31.2 cents to 22 cents, or a saving of 30%.

Iron Fireman P.S. Stokers have helped step up Georgia Vitrified Brick and Clay Company's production, by maintaining constant steam pressure, with a 41% increase in capacity.

The labor cost of manual coal handling has been eliminated by the use of Iron Fireman P.S. Bin-Feed models. These stokers convey the coal direct from the main bin or bunker to the furnace, without using auxiliary coal handling equipment.

The Georgia plant reports remarkably low maintenance. No moving parts are exposed to the fire-zone, and the grate design insures ample cooling.

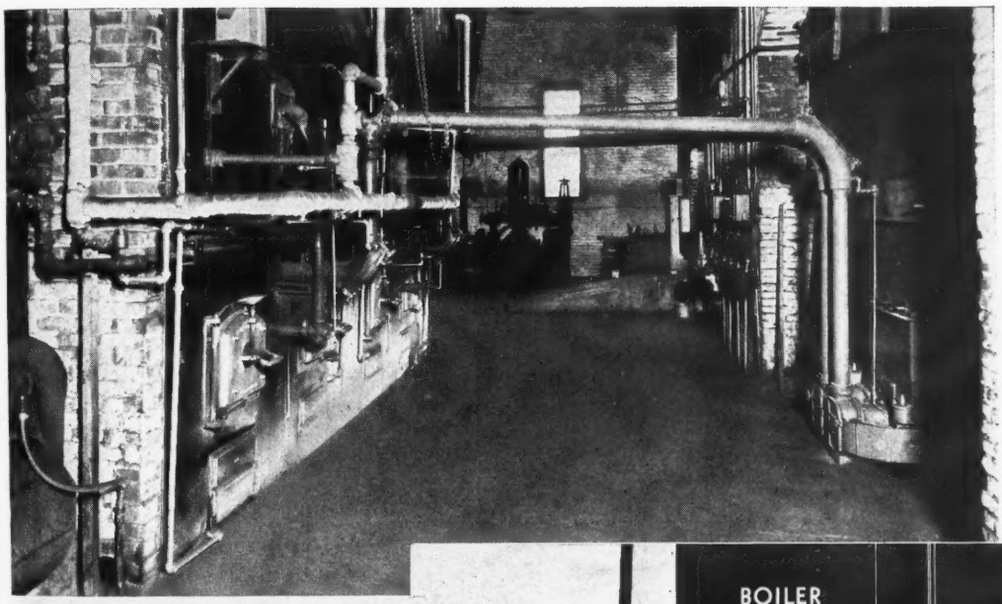
So successful has been the operation of the initial stoker in the boiler plant, that the Georgia Vitrified Brick and Clay Company has since ordered a second Iron Fireman P.S. stoker.

IRON FIREMAN
Automatic Coal Stokers

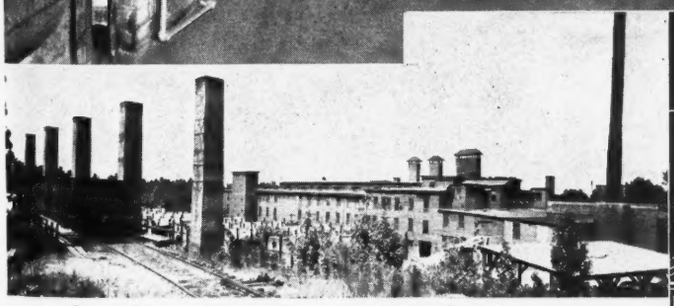
present boilers IRON FIREMAN P.S.* STOKERS

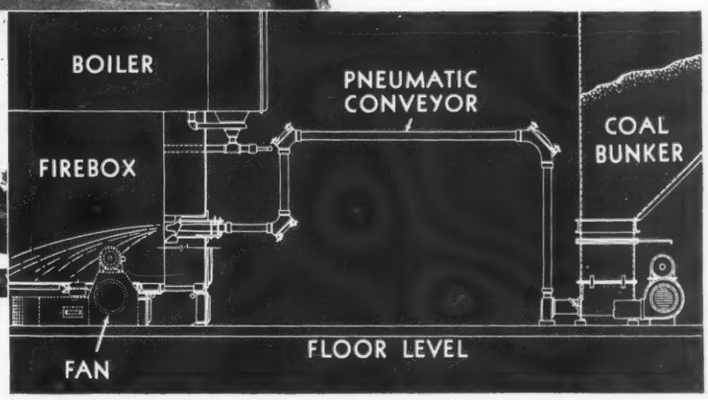
★ PNEUMATIC SPREADER

Iron Fireman Pneumatic Spreader stokers are obtaining 25% to 40% more steam, and steadier pressure, in boiler plants from coast to coast, assuring maximum output and improved quality of product. In the "Battle of Production," Iron Fireman stokers give *more fire-power!*

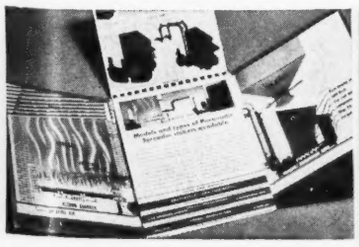


Left: One Iron Fireman P.S. stoker serving *two* boilers with its dual pneumatic conveying systems. One nozzle enters each boiler. The boilers were quickly adapted to Pneumatic Spreader firing. No alterations were required of the boiler front except the cutting of two small openings for the nozzles.





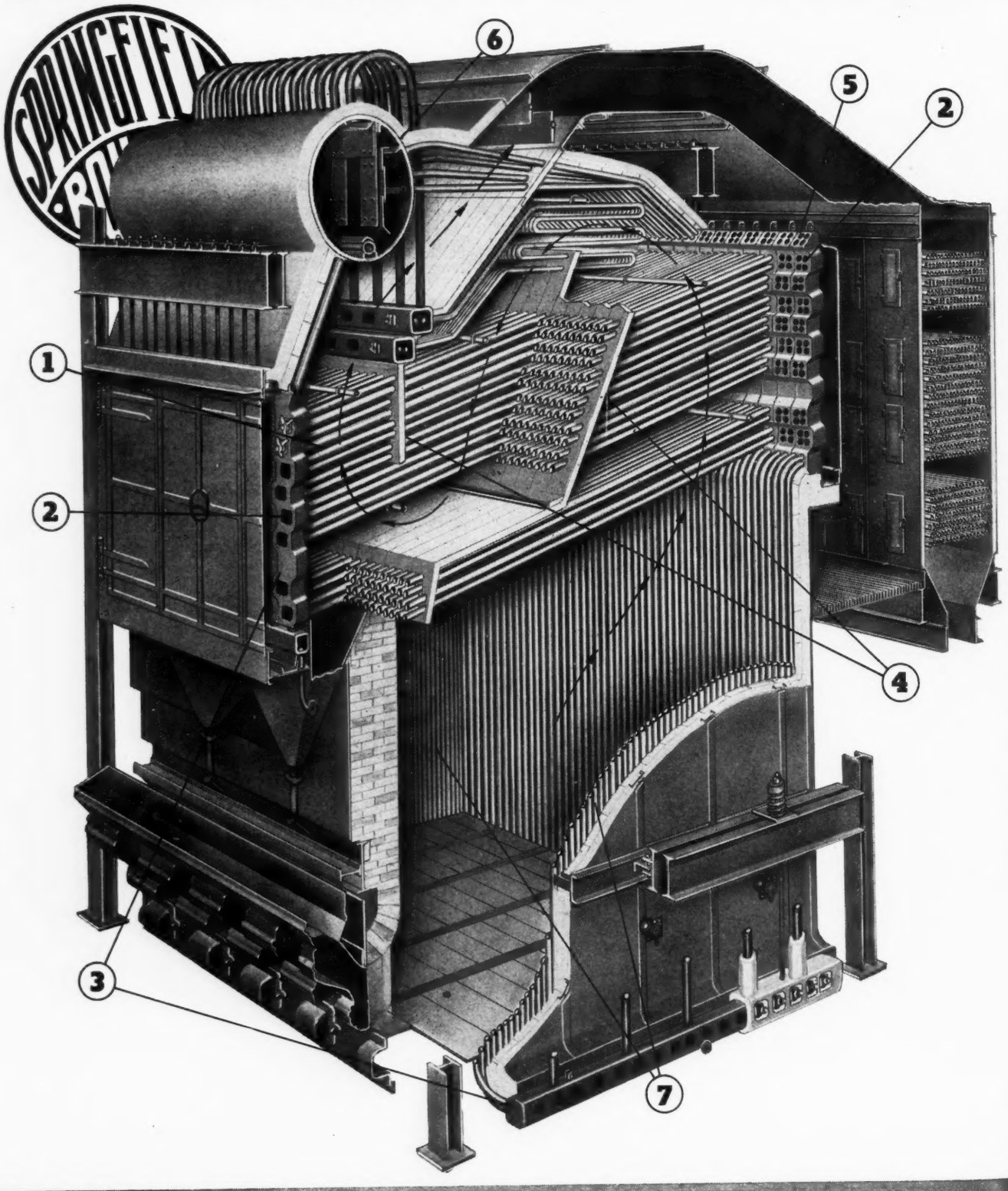
Above: Plant of the Georgia Vitrified Brick and Clay Company at Campania, Georgia—one of the largest of its type in the South. *Right:* Sketch showing how P.S. Bin-Fed model automatically conveys coal direct from main bin to boiler furnace.



FREE BOOK on Pneumatic Spreader Firing

Contains full descriptions, capacities, operating data, etc., with layouts and photos of 10 actual installations. Sent free, on request. Write to Iron Fireman Mfg. Co., 3306 W. 106th Street, Cleveland, Ohio.

FEATURES THAT MEAN



SPRINGFIELD

MODERN STEAM GENERATING UNITS

✓Easier MAINTENANCE
✓Longer Life • SAFETY
✓Greater AVAILABILITY

1 STRAIGHT TUBES. Experienced operating engineers will agree that there is nothing like a straight tube for CONVENIENCE! You can look through a Springfield tube and see that it is clean and unblemished. With one size of straight boiler tube, Springfield averages about 1/16 fewer tube sizes than common bent tube boilers.

2 4 TUBES GROUPED UNDER 1 HANDHOLE. Compared with the nuisance of having to crawl inside a drum to gain access to boiler tubes, the convenience of having tubes where you can get at them easily is a feature that meets users' enthusiastic approval. It also has other advantages—you don't have a long wait for the setting to cool when you want to look at a Springfield tube. Tubes can be inspected, or even replaced, and the boiler put back on the line in less time than it ordinarily takes to cool down the drums of a bent tube boiler. Springfield's 4-tube grouping reduces the number of hand holes two-thirds, or more, as compared with common straight tube designs. Larger hand hole opening is a real convenience in inspecting or rolling in tubes.

3 ELECTRIC FURNACE CAST STEEL HEADERS. Cast steel, the material selected for turrets and hulls of newest Army tanks, has long been used by Springfield to produce *better* headers for boilers and water walls. Backed by thirty years experience, Springfield headers are cast of high tensile strength electric furnace carbon or alloy steel, depending on the pressure, and are fully annealed. This construction provides a ductile but tough material exceptionally well suited for tight rolled joints and presents no seams or crevices to start corrosion or embrittlement.

4 WATER COOLED, REFRACTORY FILLED BAFFLES. Metal sleeve conductors between the cast baffle sections and the water tubes keeps baffles from overheating. Use of refractory filling reduces contact with hot gases. Springfield baffles fit tight, have no horizontal seams, and remain in proper position. Tubes can be easily removed without disturbing baffles which are customarily good for the life of the boiler.

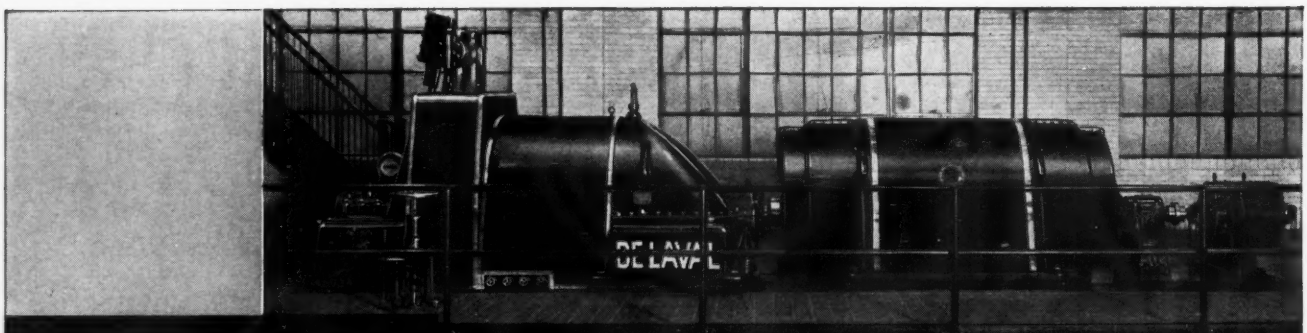
5 SHOP ASSEMBLED SECTIONS. Tube sections are made up in the Springfield shop complete with front and rear headers, baffle sections, etc. Each section is hydrostatically shop tested and inspected at pressure at least 50% over working pressure and never less than 500 lbs. Springfield's distinctive 4-tube grouping arrangement, combined with the sinuous headers gives each section rigidity and strength to withstand handling in shipping and in the field. Valuable time and labor savings, particularly on shipments going into overseas locations.

6 DRUM NOT EXPOSED TO HIGH TEMPERATURE. This is an important safety feature. Springfield's sectionalized construction makes it impossible for a large rupture to occur in the high temperature zone of the furnace.

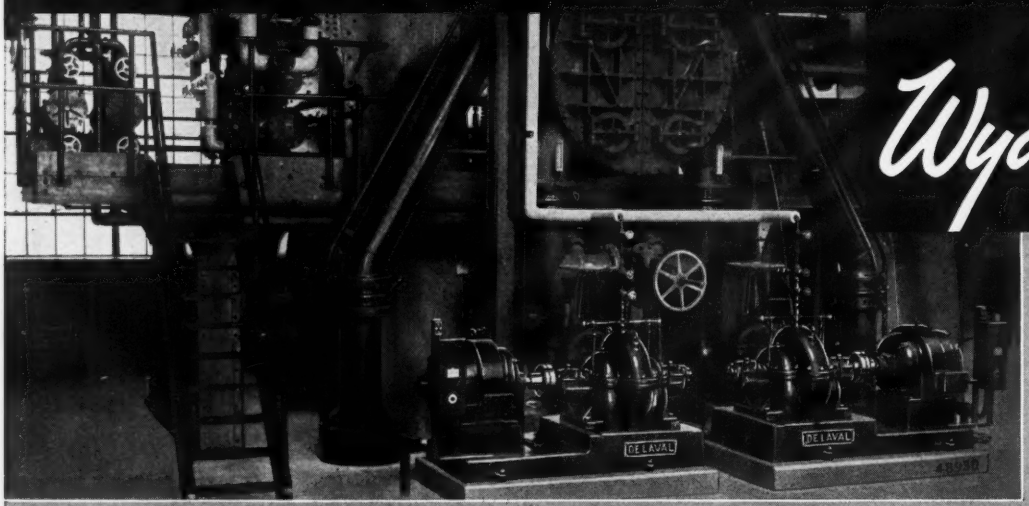
7 CLOSE SPACING WATER WALLS. Designed to permit high output with a compact unit, Springfield's water wall construction also reduces temperatures on furnace brickwork to a point where maintenance is negligible. Close spacing minimizes possibility of extreme slagging and gives greater protection against high local heating with the result that Springfield water walls are less affected by bad water conditions.

DELIVERY. Organizations engaged in war work, or otherwise able to obtain priority ratings, can get quicker delivery—save money—and aid in conserving metals on steam plant requirements by taking advantage of the distinctive construction features of Springfield straight tube, cross drum, sectional header boilers. Complete drawings, patterns, shop fixtures, etc., are on hand to duplicate any of the many modern Springfield steam generating units built in recent years. Capacities from 5000 lbs. to 450,000 lbs. per hour, or more. Pressures from 75 lbs. to 750 lbs., or higher. Springfield regularly takes contracts for complete steam generating units. Write, phone, or wire for quotations. SPRINGFIELD BOILER CO., 1953 E. Capitol Ave., Springfield, Illinois.

BOILER CO.
ANY SIZE • ANY FUEL • ANY PRESSURE



DE LAVAL TURBO-ALTERNATOR at Wyandotte



IN 1938, the City of Wyandotte, Mich., placed an order for a De Laval turbo-alternator to generate 4,000 kw. (5,000 kw. maximum) from steam at 425 psi. and 720° F., to be operated condensing, but with bleeder connections for feed heating and for heating the Wyandotte City Hospital. This unit, which has been in continuous service since January, 1940, operates in parallel with an older 2,000 kw. generator and with the power system of the Michigan Alkali Company.

The turbine is of the impulse type, with ample bucket clearances and with provisions to equalize expansion. An accurate and sensitive fly-weight governor controls the admission valves through two stages of hydraulic relay amplification and can be set manually or by the remote synchronizing device. The entire governor mechanism is housed in the turbine base, without exposed piping or mechanism.

Constructional details have been designed for high pressure, high temperature steam, with segregation of moisture in the low pressure stages.

The installation includes De Laval condenser circulating pumps, condensate pumps, boiler feed pumps and lubricating oil purifier. A similar De Laval unit rated at 6,000 kw. has since been ordered.

Further particulars are given in Leaflet T-3521, sent upon request

DE LAVAL Steam Turbine Co.
TRENTON, N. J.

MANUFACTURERS OF TURBINES . . . STEAM, HYDRAULIC. PUMPS . . . CENTRIFUGAL, PROPELLER, ROTARY DISPLACEMENT, MOTOR-MOUNTED, MIXED-FLOW, CLOGLESS, SELF-PRIMING, CENTRIFUGAL BLOWERS and COMPRESSORS, GEARS . . . WORM, HELICAL and FLEXIBLE COUPLINGS

VOLUME 86, No. 6

STEAM GENERATION
POWER GENERATION
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PUMPS & COMPRESSORS
PIPING, VALVES & FITTINGS
AIR CONDITIONING, REFRIGERATION
ELECTRICITY AND CONTROLS
INSTRUMENTS AND CONTROL
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WATER TREATMENT
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MISCELLANEOUS

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JUNE, 1942

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BIG TURBINE FEATURES

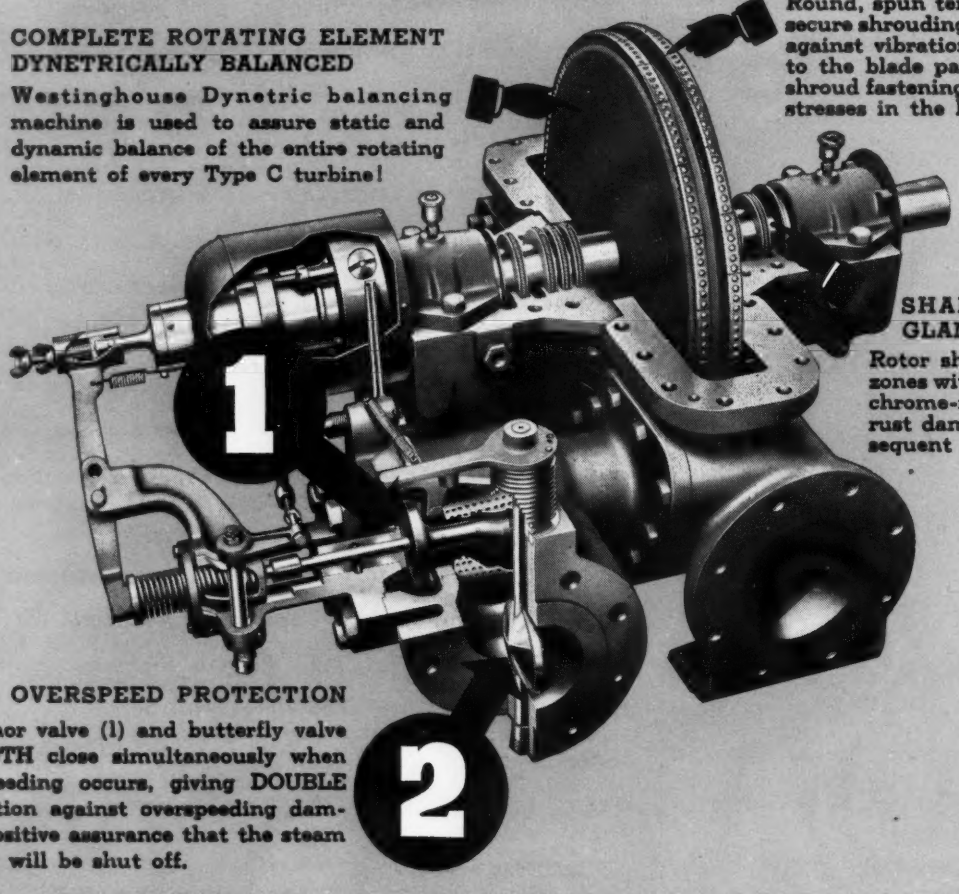
FROM 5 HP UP

SPUN TENONS SECURE THE SHROUDS

Round, spun tenons at the blade ends secure shrouding, which stiffens blades against vibration, and confines steam to the blade path. Result: a uniform shroud fastening, without setting up of stresses in the blades.

COMPLETE ROTATING ELEMENT DYNETRICALLY BALANCED

Westinghouse Dynetric balancing machine is used to assure static and dynamic balance of the entire rotating element of every Type C turbine!



SHAFT PROTECTED AT THE GLAND ZONES

Rotor shaft is protected at the gland zones with a sprayed-on surface of high chrome-nickel steel alloy. This prevents rust damage to carbon rings and consequent steam leakage.

DUAL OVERSPEED PROTECTION

Governor valve (1) and butterfly valve (2) BOTH close simultaneously when overspeeding occurs, giving DOUBLE protection against overspeeding damage, positive assurance that the steam supply will be shut off.

why steam headquarters can give you the "most turbine for the money!"

- **DUAL PROTECTION**—Overspeeding trips two valves at once.
- **SPARKLESS OVERSPEED TRIP**—(When required by operating conditions) with Micarta insert.
- **SHAFT PROTECTION**—Shaft sprayed with high chrome-nickel steel at the gland zones to prevent rust-cutting of carbon rings.
- **SPUN TENONS**—Provide a smooth, secure shroud fastening without stresses.
- **DYNETRICALLY BALANCED ROTOR**—Entire rotating element dynamically balanced.
- **CONTOURED STEAM PATH**—All nozzle and blade contours designed for maximum efficiency.
- **CHROME-ALLOY BLADES · ACCURATE SPEED REGULATING GOVERNOR · BABBITT-LINED BRONZE BEARINGS · STEAMTIGHT, FINISH GROUND CASING FLANGES · CYLINDRICAL STEAM STRAINER AROUND INLET VALVE · NO SOFT PACKING ON INLET VALVE STEM.**

All Westinghouse Turbine designs have their basis in the same great pool of engineering experience. The same research technique, the same design standards, the same manufacturing facilities—are available for development of a 5 hp turbine or a 100,000 kw turbine-generator. And beyond this specialized ability to build turbines is Steam Headquarters' broad experience covering virtually the entire field of steam equipment.

It takes that kind of an organization to build BIG TURBINE FEATURES into economical, general purpose turbines. That's what we've done with the family of Westinghouse Type C Turbines. You'll find in them a combination of features present in no other turbines except in much larger ratings. You'll find in them the "most turbine for the money!" For complete information write for Booklet 2230-A, Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa., Dept. 7-N.

J-50406

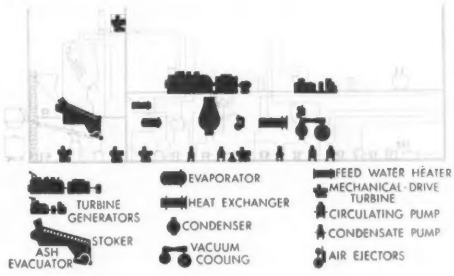
extra values in all these products of steam headquarters

1. equipment

A complete range of steam turbines for mechanical or generator drive, from 5 hp to the largest . . . with a full line of auxiliary steam equipment.

2. engineering

A complete engineering service to help you select and apply the steam equipment best suited to your requirements.



Westinghouse

The "EXPERIENCE POOL" can help you solve today's toughest problems

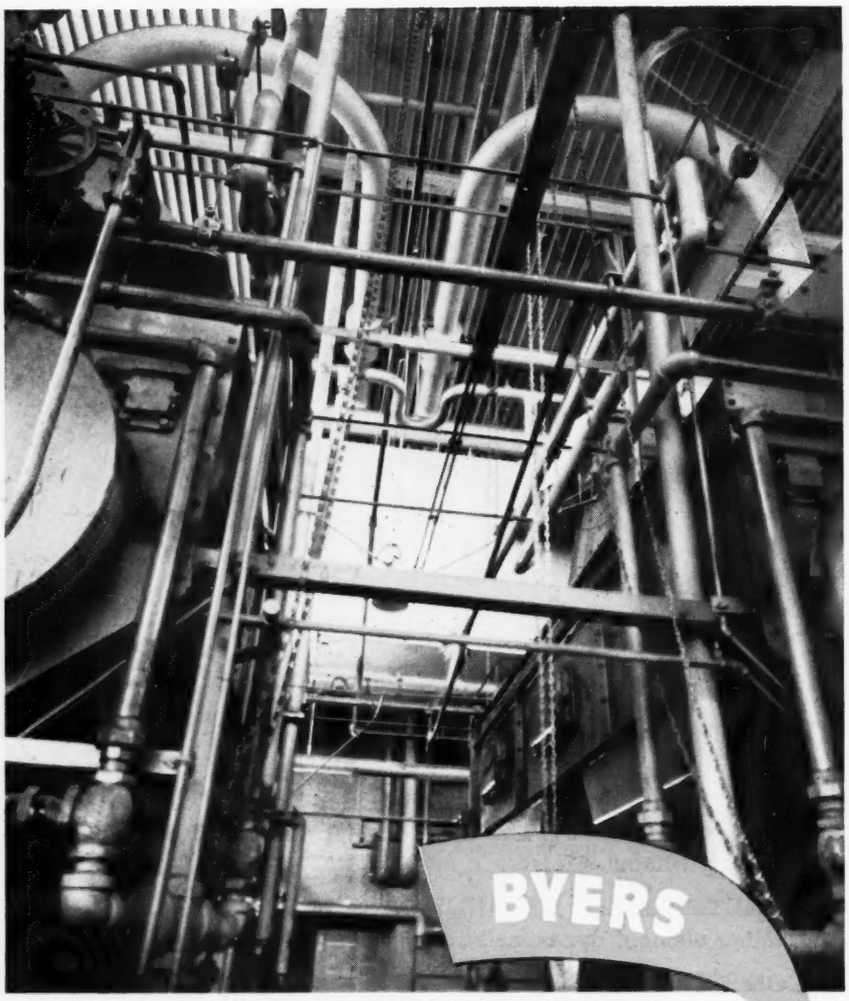
Avoiding repairs and interruptions depends heavily on proper selection of materials. This job has been complicated by shortages of some of the metals ordinarily used, and by the fact that many key men have been forced to delegate duties, without being able to delegate their experience. If you have any such problems, the Byers "Experience Pool" can help you as it is helping others.

Our Engineering Service Department has for years been collecting performance records on all kinds of materials in all kinds of services. This has been supplemented with water analyses (our file of these alone covers the supply of over 600 municipalities) general corrosion data, and analytical studies made by our laboratories. Altogether this material constitutes the largest known collection of practical engineering experience on wrought iron and corrosion problems available anywhere. It provides a ready-to-use guide for the specifier who has no time for experiment, and who must be *sure*.

There is no red tape, and no cost or obligation, in using this "Experience Pool." If you have any applications where corrosion or fatigue failure creates a potential production problem, write us. Our recommendations will be supported by field performance records.

A. M. Byers Co., Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Chicago, St. Louis, Houston, Seattle, San Francisco.

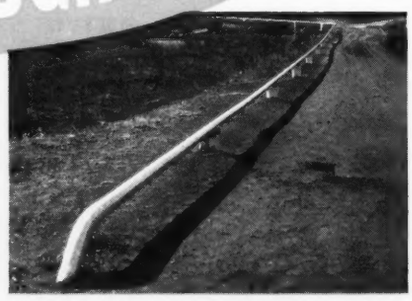
Corrosion costs you more than Wrought Iron



EXPERIENCE BACKS WROUGHT IRON FOR THIS BOILER ROOM PIPING. All piping shown in this picture is Byers Wrought Iron, a choice that is confirmed by the record. For example: in one boiler room, wrought iron boiler shells, steam supply lines, boiler feed lines, and fire sprinkler lines were all still serving at last reports, after more than 30 years on the job. Ask for Piping Bulletin.

WROUGHT IRON

EXPERIENCE OK'S WROUGHT IRON HERE. This 112-foot wrought iron stack was shop-fabricated in two sections, and bolt-assembled before erection. Records definitely prove wrought iron's superior resistance to smoke-corrosion. Ask for Stack and Coal Handling Equipment Bulletin.



EXPERIENCE RECOMMENDS WROUGHT IRON FOR AIR LINES. Wrought iron's unique structure discourages local pitting, and guards against the pin-hole leaks that cause premature failure of ordinary materials. Many miles of wrought iron air lines are now serving.

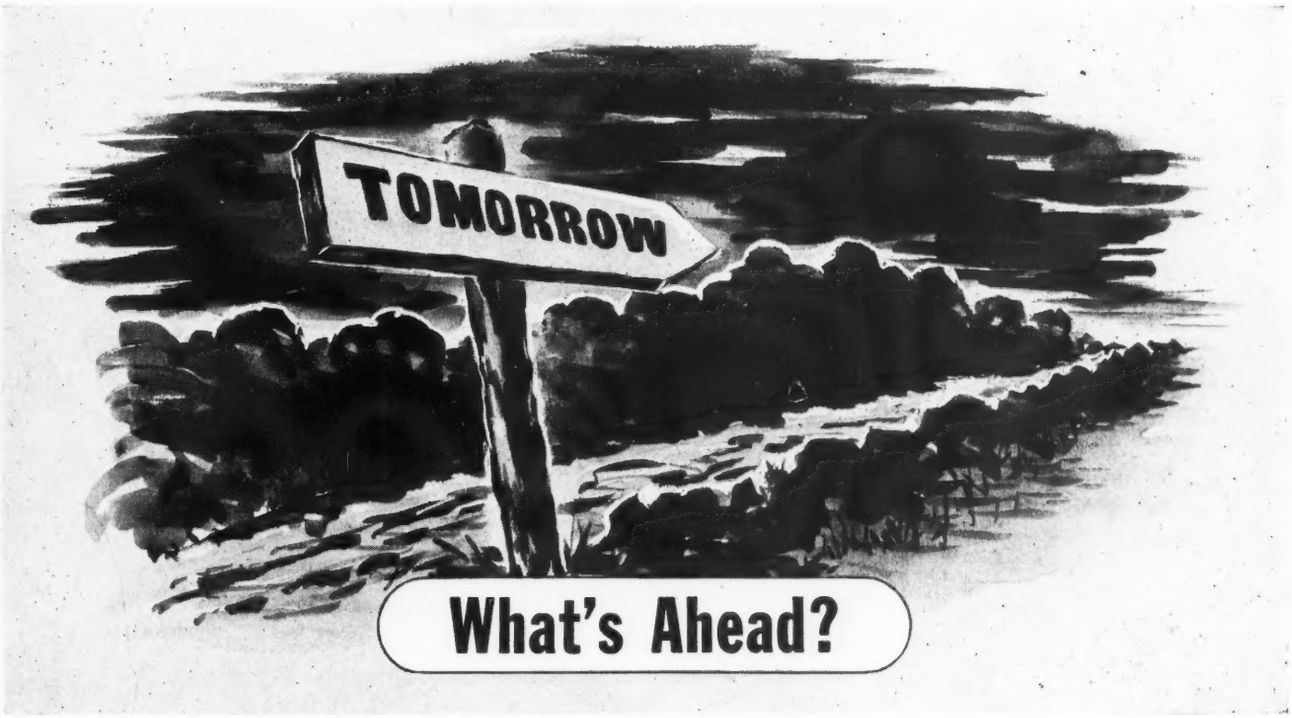
BYERS GENUINE WROUGHT IRON

TUBULAR AND HOT ROLLED PRODUCTS

STEEL TUBULAR PRODUCTS

POWER

Established 1882 • PHILIP W SWAIN, Editor



What's ahead for power men? The answer is "more trouble" —and by the same token, the chance of a lifetime to demonstrate practical leadership!

Already we've had a few samples of what's to come. Even before Pearl Harbor it was hard enough to get deliveries on major power units—boilers, turbines and diesels. Today the navy and merchant marine have first call on such units, and their demands are enormous.

Every type of war production is booming and using strategic materials so fast that none is left for non-essentials and little for uses that may seem highly essential to those concerned. The power-man's list of scarce necessities now includes bearings, pipe fittings, cable, copper, brass, bronze, zinc, alloy steel, tin, babbitt, solder, small tools, rubber hose, rubber and leather belting. This list will grow; welding electrodes and oxygen are right around the corner.

Clearly the engineer must learn how to skimp and save all these items, applying to the task his own experience and ingenuity and the many suggestions recently published in POWER and elsewhere. Like the Israelites under Pharaoh, he must "make bricks without straw".

On top of that he must face a growing shortage of manpower. Some of his bright young men—maintenance men, electricians, shift engineers, steam fitters and firemen—are sure to receive selective-service "calling cards" from General Hershey. These might appear to be "essential men in an essential industry", but they can't all stay in the plant if we hope to raise an army big enough to lick the Axis.

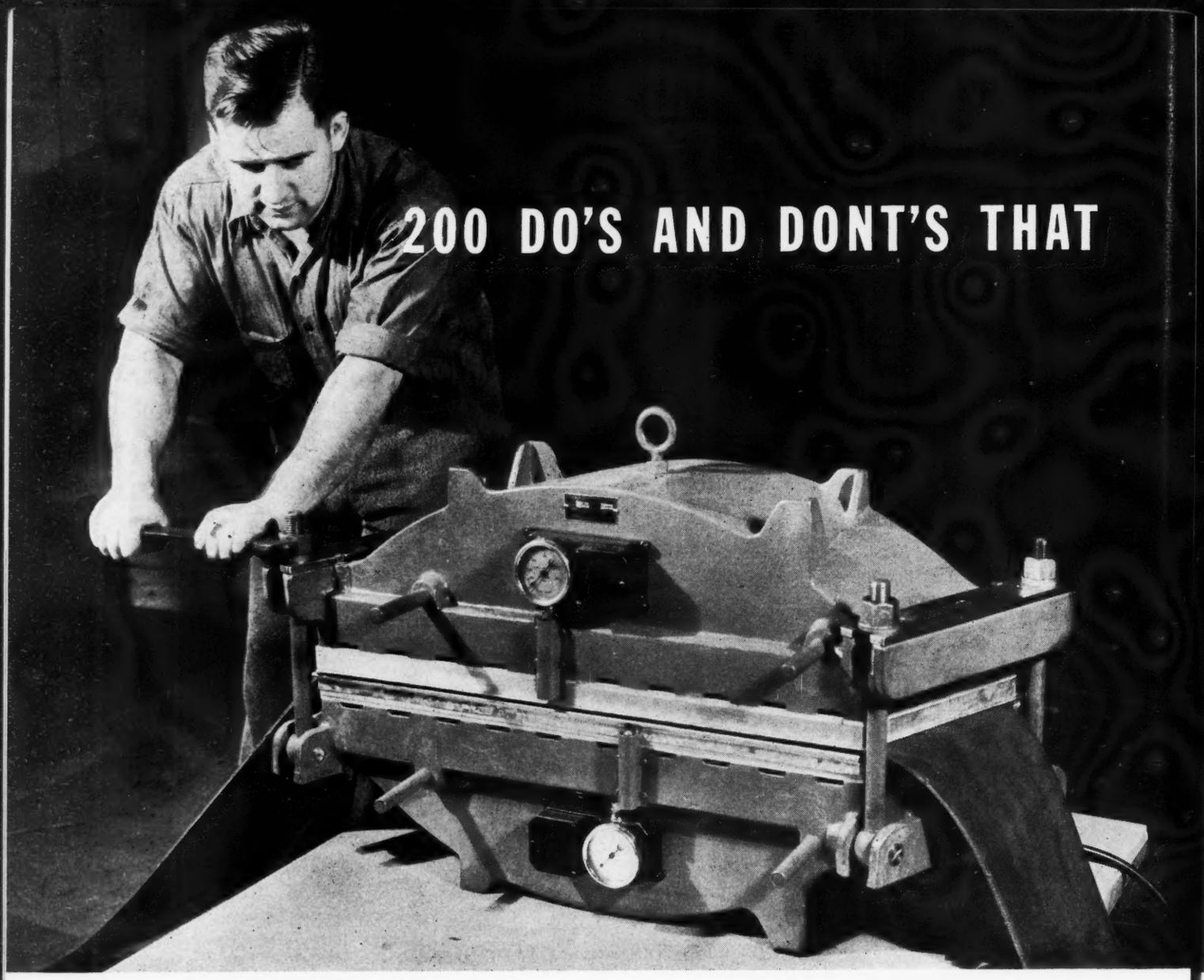
At home the power engineer will share the war time burdens of all citizens—shortage of tires and gasoline, rationed sugar, community air-raid service, etc. Every month there will be more of these domestic "fleabites".

Thus the power man must face the months ahead gravely short of materials and equipment, increasingly short of experienced help, and burdened at home with many petty annoyances.

With this reduced wherewithall he will be expected to carry the biggest power and steam loads of history for longer factory hours, with less time for maintenance than ever before. Yet he will not be excused for any failure of essential services.

When his factory "converts" to war work, as thousands will, the management will expect him to reach out into the thin air and gather all things needful to deliver enough air and steam and electricity and mechanical power to all the new productive machines in their new locations in buildings old and new.

In a way this is a rather sad picture, yet it has the makings of real personal satisfaction. Despite the many conveniences of modern life, the men of American industry are not too far from the pioneers who chopped down the trees to clear the wilderness. They still rise to the challenge of a situation. They still take pride in licking the tough problem. They will give this one what it requires—level-headed appraisal and planning, staff organization and leadership, hard work and guts!



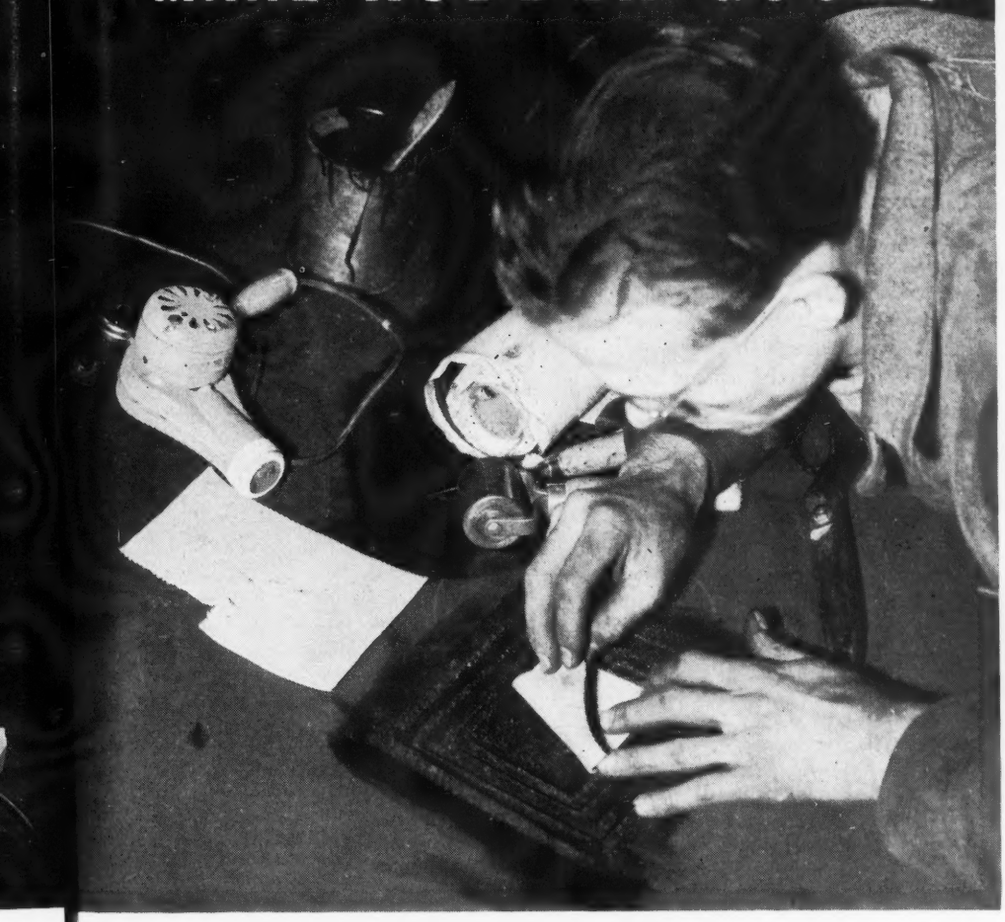
200 DO'S AND DONT'S THAT

WHEN we cannot get what we want when we want it, then the next best thing is to make the most of what we have. This is just the situation with rubber. Mechanical rubber goods are used in many forms in power and industrial plants — power-transmission belting, conveyor belts, hose, tank linings, mats, clothing, shock absorbers and many others. Because of conditions developing out of the war, our government has placed drastic restrictions on the manufacture and sale of these and other rubber products. Therefore, every plant engineer must turn his attention to ways of making the rubber products he has last longer.

Most mechanical rubber goods consist of a cotton fabric impregnated and covered with rubber. In taking care of these products it should be remembered that the fabric supplies all the structural strength and the rubber protects the fabric from abrasion, impact, corrosive fumes and liquids, and other injurious effects. It is imperative therefore that the rubber never be subjected to conditions that will destroy it or the whole structure will fail.

The 200 or more suggestions given here on how to get more life out of rubber goods, compiled with the assistance of B F Goodrich Co, Manhattan Rubber Mfg Div, Raybestos-Manhattan, Goodyear Tire and Rubber Co, Robins Conveying Belt Co, and Republic Rubber Co, should not be interpreted as indicating that these goods are fragile and cannot stand abuse. Quite the reverse is true; there are few products that can stand more abuse than mechanical rubber goods. However, this is no reason for abusing them, particularly when replacement will be difficult and when proper care will increase their useful life from 10 to 200%. In the present emergency this is a patriotic duty, and at any time it is good business. The following pages show how it's done ➡

MAKE RUBBER GOODS LAST LONGER



Proper care will increase useful life of vital rubber products from 10 to 200%. Good business at any time, in the present emergency it becomes the power engineer's duty to know how to install, operate and maintain belts, hose and other mechanical rubber goods for maximum service. Here are 200 practical suggestions

TRANSMISSION BELTS

▶ STANDARDIZE on as few widths and plies of rubber belt as will economically meet plant requirements, to reduce the amount of spare belting necessary.

Modern rubber belts are highly antioxidant and have high resistance to aging, but if stored should be kept in a cool dark place away from sunlight, heating pipes, oil, excessive moisture and corrosive fumes.

Use endless belts wherever possible.

Before joining belt ends with lacing or other forms of mechanical fasteners be sure that ends are absolutely square.

Always use a steel square as a guide for the knife to cut the belt square.

Provide as much space as possible between the belt ends and the nearest row of fastener or lace holes.

Use the belt punch sparingly and do not use too many or too large holes for lacing or fasteners.

Remember that material taken out of a belt for fastener holes is just that much deducted from its strength.

Use proper size and type of fasteners for the belt and the pulleys it must run over. Using wrong size fasteners may cause them to pull out of the belt.

Do not use plate or other heavy fasteners in belts that run with reverse bends or under an idler.

Renew worn fasteners before they break and damage the belt.

Inspect joints in belts periodically and repair them at the first signs of distress.

All belts except narrow ones and those operating on adjustable centers should be joined on the pulleys, by pulling them together with clamps before making the joint.

Do not use a rope to put a belt on its pulleys.

Do not try to put a belt on its pulley at high speed.

Do not use undersized pulleys or they will cause fasteners to pull out or fail; "bootlegging," blistering, ply separation or air pockets may occur in the belt.

Use pulley as large as conditions will permit up to sizes that will give a belt speed of 5000 fpm, as the amount of power transmitted by a belt increases approximately in direct proportion to pulley size.

Do not operate belts at speeds above 5000 fpm if it can be avoided, or without consulting the belt manufacturer.

When folded belts are used it is preferable to run them with the seam on the outside except where the pulleys have excessive crown.

Avoid excessive crown on pulleys or it may produce strains along the centerline of the belt that will cause premature failure of the fasteners, and ply separation.

Don't run belts on flat-faced pulleys except on shifter drives.

Select belts of proper thickness and

width for the pulleys and the load.

Avoid thick narrow belts and wide thin ones.

Use pulley ½ to 2 in. wider than the belt.

Align shafting and pulleys so that the belt center will run true on center of pulley faces. Poor alignment causes premature failure of fasteners, may give the belt a permanent crook or cause it to run off the pulleys.

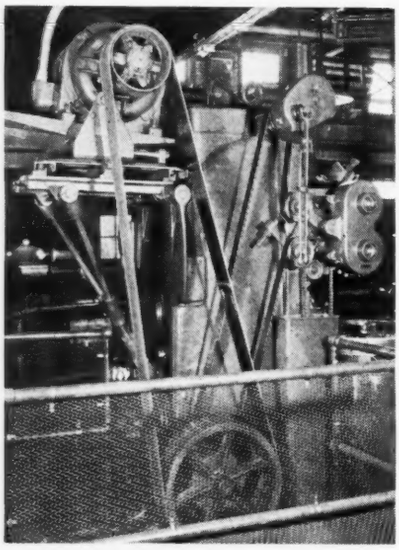
Do not operate a belt running off one side of the pulleys. Its fasteners may fail and the belt may stretch unevenly across its width and tend to run crooked.

Do not let the belt rub against stationary objects or they will wear its edge, rip out the fasteners or tear the belt lengthwise.

Avoid vertical drives wherever possible, but if they must be used select a belt of ample capacity for the load and conditions under which it must operate.

On vertical individual motor drives mount the motor on an automatic tension or a pivoted base.

Avoid idlers if possible, as they put a reverse bend in the belt. If you must



For efficiency on vertical drives mount the motor on an automatic tension base

use them, use an approved unit, properly installed.

Do not use crowned idler pulleys because they put a reverse bend in the belt across its width, which may cause ply separation, blistering and fastener failure.

Avoid idlers that bounce off and fall back on the belt. Belts have been broken in two by such action.

Avoid idlers on short-center individual drives by mounting the motor on an automatic tension or a pivoted base.

Where possible operate belts with the slack side on top. This increases its arc of contact with the pulleys.

Avoid shifters that do not throw the belt entirely off or on the loose pulley. Otherwise one side of the belt will be stretched more than the other and it will run crooked.

Give careful attention to belt shifters to see that they are not abusing the belt and causing edge wear.

Use shifters with anti-friction bearings in their sides as they greatly reduce belt-edge wear.

Keep belts aligned on flanged pulleys. Just because the flanges prevent the belt from coming off the pulleys is no reason for neglecting to maintain good alignment and letting the belt wear itself out on the flanges.

Operate belts with the minimum tension that will prevent slipping. A properly aligned and operated rubber belt should run a long time and stretch very little.

Do not let a belt slip excessively or it will burn the rubber and fabric. A belt should not creep and slip more than 2%. Check this with speed counter and pulley ratios.

Do not operate a belt too tight or it will fail prematurely and may overheat the shaft bearings.

Where excessive tension is required to prevent slipping, substituting a wood or a fiber pulley for a small steel one may give relief. Lagging the small pulley with rubber or duck may also permit carrying the load with reduced tension. Several plys of duck may be cemented to the pulley with good rubber cement. On individual motor drives mounting the motor on an automatic tension or a pivoted base will permit operating with reduced tension in the belt. Where a tension base cannot be used an idler, properly selected and installed, may solve the problem.

Keep all obstructions away from the side of the belt that it might rub against if it were to run off one side of the pulleys.

If a new rubber belt slips the trouble can sometimes be corrected by washing the white powder coating from the surface in contact with the pulley.

Dress the belt sparingly and only when actually needed.

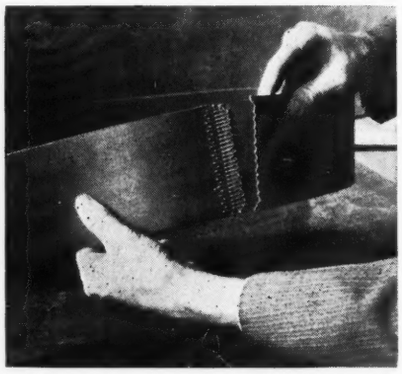
When a rubber belt needs a dressing to remove the glaze on its pulley surface and to slightly soften this surface so that it will make better contact, use a light application of vegetable castor oil applied uniformly with a cloth.

Excessive applications of oily dressing will act as a lubricant and increase belt slipping on the pulleys.

Do not use resin or other sticky belt dressings. They tend to cake and build up lumps on the belt and pulleys that subject the belt to stresses that may prove disastrous.

Keep both belt and pulleys clean.

Keep lubricating oil from bearings or other sources from getting on rubber belts. In time oil destroys the belt structure, causing it to stretch unevenly, run crooked and its fasteners



An undersize pulley caused outside ply of this belt to break at the fasteners

to pull out. Even vegetable castor oil if applied too frequently will soften the surface of the rubber to a point where it will wear off faster than normal and shorten belt life.

When rubber belts must be operated in the presence of mineral oil use synthetic rubber designs that are highly resistant to oil.

Watch for adverse operating conditions and correct them before they have time to cause excessive wear or complete belt failure.

Don't overload a belt and expect good service.

Do not operate belts exposed to the weather or excessive heat if it can be avoided.

For high temperature applications use synthetic-rubber belts.

Don't operate rubber belts in the presence of acid fumes or in excessive moisture without first getting the manufacturer's recommendations.

Make one man responsible for motor and shaft lubrication and for maintaining proper tension in the belts; he can then be held responsible for failure of all these related operations.

V-BELTS

▶ STORE V-BELTS in a dark, cool place.

Use a sufficient number of belts of the correct size to handle the maximum load.

Don't use undersize sheaves; they require unnecessary tension in the belts, cause undue bending stresses, overheating and breakdown of belt structure.

Use matched sets of multiple-V belts.

Don't overload the belts and expect good service.

Provide sufficient takeup so that the belts do not have to be discarded before they are worn out.

Make sure that belts and sheave grooves match. Grooves too small cause belts to ride too high and, if too large, cause belts to ride too low.

Use standard belts and sheaves to make it easier to get replacements.

Don't operate V-belts at speeds above 5000 fpm if it can be avoided. If it can't be avoided, consult the manufacturer for recommendations.

Use sheaves as large as conditions will permit up to sizes that will give a belt speed of 5000 fpm, as the amount of power transmitted by the belts increases in approximately direct proportion to sheave pitch diameter.

Keep shafting and sheaves in good alignment. Poor alignment puts uneven tension in the belts and causes excessive side wear on belts and sheave grooves.

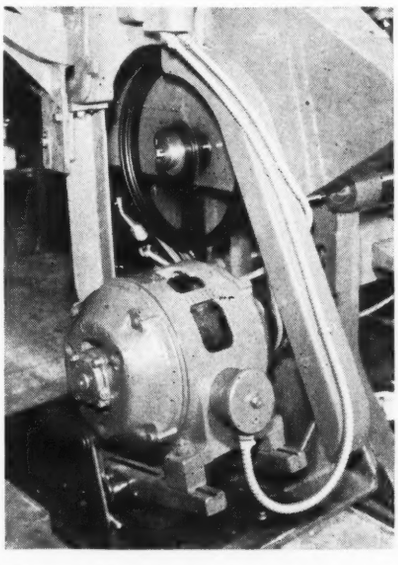
Do not let belts run against fixed objects as they will wear their sides and tear them.

Avoid vertical drives whenever possible, but if they must be used, use an ample number of belts for the load and conditions under which they must operate.

On vertical individual motor drives mount the motor on an automatic tension or a pivoted base.

When possible, operate the drive with the slack strands of the belts on top.

Where drives are operated with the slack in the bottom strands, a properly applied idler to reverse the slack-side sag in the belts will improve the drive



Mounting the motor on an automatic tension base solved the problem on this drive

where operating conditions are severe.

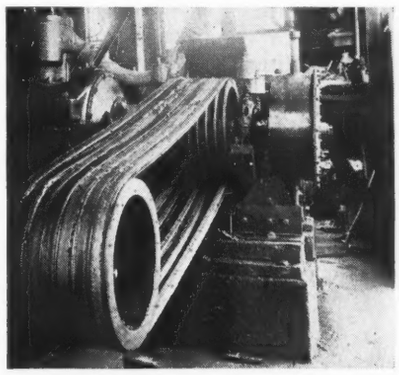
Do not use an idler to put tension in the belts.

Operate the belts with the minimum of tension that will drive the load without slipping.

After belts are first installed a few days are required for proper seating into the sheave grooves, after which the belts will tend to get slack. This will have to be taken out by adjusting the center distance between the sheaves. After this a properly designed V-belt drive should operate for several months without further adjustment.

Don't operate V-belts too tight because they will be wedged down into the sheave grooves, reducing their efficiency and life, and causing unnecessary internal heating of the belt.

On individual motor drives where more than normal tension is required



These V-belts were injured operating under conditions that were excessively oily

in the belts to prevent slipping, mount the motor on an automatic tension or a pivoted base.

Keep lubricating oil from bearings and other sources off the belts. In time oil destroys the rubber and lets the belts collapse.

Use synthetic-rubber belts when they must operate in the presence of mineral oil.

Don't operate V-belts in acid fumes or excessive moisture without first getting the manufacturer's recommendations.

Keep V-belts and sheave grooves clean and free from harmful burrs and see that they are not unduly worn and that groove corners are not sharp.

Don't leave tools or other objects where they can fall on belts and injure or break them.

Don't operate V-belts exposed to the weather, direct sunlight, or in temperatures in excess of 130 F if this can be avoided.

Use synthetic-rubber belts for temperatures above 130 F or operations in direct sunlight.

Replace the set, not a single belt, when belts become worn.

Don't use a bar to pry V-belts on their sheaves. The bar may rupture the belt structure and cause short life.

Run motor back far enough so that the belts will have sufficient slack to slide easily over the small sheave when putting on or taking off V-belts.

Replace belts when they become worn before they bottom in the sheave grooves.

Don't use belt dressing on V-belts.

Don't operate V-belts in sheave grooves that have rusted.

Remove the belts and store them in a cool, dry place when the drive is to be out of service for some time, and coat the sheaves with grease to prevent rusting. Clean the sheaves of all traces of grease before replacing the belts.

Watch for adverse operating conditions and correct these before they can cause excessive wear of the belts or a complete failure.

CONVEYOR BELTS

► MANY SUGGESTIONS MADE for transmission belts apply to conveyor belts.

Give careful attention to the loading chute, as much harm and wear can be caused to the belt at this point.

Arrange loading chute so that material will be delivered to the belt in the direction the belt runs and at the same speed.

Don't drop material on the belt; slide it on.

Don't let the chute rub on the belt.

Where possible, have loading chute directly over the belt.

Do not load at an agle from the side if this can be avoided as the side thrust of the material increases wear on the belt and may make it run crooked.

Turn discharge end of chute so that load comes on the belt in direction of travel, if loading is from the side.

Install screen in bottom end of chute or cut back its center at discharge end so that fines can come onto the belt first to protect it from the impact of the lumps.

Watch screen to see that it does not become clogged.

Install baffles at discharge end of chute, if it is too steep, to ease material on the belt.

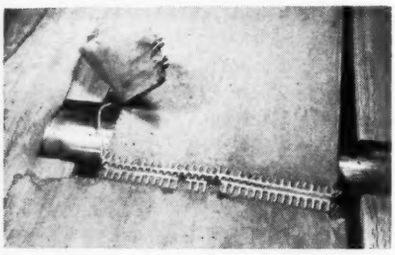
Don't slow up material too much with baffles, or conveyor will be only partly loaded.

Keep conveyor properly loaded, so entire working surface of belt is util-

ized and wear on it decreased for a given tonnage handled.

Provide skirt boards, three to four times belt width in length, and set in about 6 in. from side of belt at discharge end of chute, to insure good loading formation on the belt and prevent spillage.

Set skirt boards so that space between them and belt increases in direction of belt travel so that pieces of material that get in between the boards and belt will work free and not become wedged against the belt and gouge its cover.



Rubbing against an obstruction caused the fasteners to break and rip this belt

Do not let skirt boards get out of adjustment, rub on the belt and cause excessive wear.

Space idlers more closely at loading chute than along normal length of belt—do not place an idler directly under loading section of belt.

Use rubber-covered idlers at loading section or idlers supported on shock-absorbing rubber to ease the shock of the load coming on the belt.

If return strand does not train properly, use self-training idlers.

Use anti-friction-bearing idlers.

Keep idlers clean and free from lumps that may build upon them.

Keep idlers properly lubricated and see that they run freely.

Avoid stuck idlers; they deflect and wear the belt, as do idlers out of line.

Listen for squeaking idlers as a danger signal of insufficient lubrication that may lead to trouble.

Lubricate idler properly, but do not over-lubricate; grease and oil are destructive to rubber.

Do not apply excessive pressure when lubricating idler bearings; it forces out the grease seals and permits entrance of dirt.

Watch for misplaced troughing idlers; they may rise out of their fastenings or return idlers may work along their shafts.

Do not use idlers with a broken edge or otherwise defective.

Do not let material collect along the conveyor or idlers that may wear the belt or prevent the idlers from turning.

Protect belt against running crooked, either from misaligned idler, improper loading, belt not being cut square at the joint, or other causes.

Keep head and tail pulleys in good alignment.

Use endless belts where possible; they can now be made endless easily in the field.

Don't let the belt edges rub against stationary objects, as they tear the edge of the belt, expose the fabric and permit the entrance of moisture that may cause the belt to stretch more on one edge than on the other and run crooked.

Protect return strand of belt against lumps falling on it and being carried between belt and tail pulley.

Keep pulleys clean; moist material tends to collect on pulleys and form an uneven surface that distorts the belt, and may break the fabric or crack the rubber covering.

Build a decking over the return strand as protection against lumps getting between belt and pulleys.

Edge wear on this conveyor belt was caused by rubbing against an obstruction

Do not operate the belt with excessive tension.

Don't let belt slip on head pulley. Search out the cause and correct it if belt cannot be prevented from slipping without excessive tension. Increased friction, due to improperly lubricated idlers, accumulation of material along belt and around idlers, overloading of inclined conveyors, all cause belt slipping.

Apply lagging to head pulley to increase coefficient of friction and permit operating with reduced tension in the belt.

Soften the pulley surface of the belt with a mild application of vegetable castor oil or dressing recommended by the belt manufacturer if it becomes hard and glazed.

Repair all breaks in the rubber cover of the belt as soon as they occur, to keep out moisture and dirt. Use an electric vulcanizer where possible. If lack of time or equipment makes it impossible to vulcanize repairs, make emergency cold-patch repairs, but do not run belts that are torn or worn to the fabric. If a temporary repair is made, replace it with a vulcanized one as soon as operating conditions will permit.

When belt fasteners are used to join the ends of the belt, inspect them frequently and repair them at the first signs of failure, so that they cannot tear the belt.

Establish an organized system of belt and conveyor equipment inspection and repair all defects when found.

Adequately house the conveyor whenever possible.

Don't expose the belt to direct sunlight for long periods.

Don't expose the belt to temperatures above 130 F.

Use synthetic-rubber or other special rubber-compound belts for temperatures above 130 F.

Where belts operate in temperatures below freezing, take care that lumps of ice or dirt do not accumulate on the pulleys.

If a belt is wet when shut down in low temperatures, before starting again see that it is not frozen to pulleys or the rubber may be pulled away from the fabric structure of the belt or the lagging pulled off lagged pulleys.

Use trippers with pulleys as large as possible, and don't let the belt rub the tripper frame.

Don't use a scraper to clean the belt at the discharge; if the belt needs cleaning use a revolving cleaner and see that it makes proper contact with the belt.

Always unload conveyor before stopping, so that it will start easily. If conveyor is stopped loaded in an emergency, get it going again as soon as possible.

When a conveyor must operate continuously under wet or moist conditions, use a belt treated to resist mildew.

COMPRESSED-AIR HOSE

▶ SELECT HOSE DESIGNED for a pressure not less than that under which it must operate.

Keep oil out of air lines by maintaining the compressor in good operating condition, properly lubricating the compressor, using aftercoolers, using receivers of ample size, and keeping them drained, and using oil and water separators on the air lines whenever there is a trace of oil.

Use synthetic-rubber hose when impossible to avoid oil in the air.

Don't prolong exposure of outside of hose to sunlight, heat, acid fumes or oil if it can be avoided.

Don't strain hose by pulling it; it was not made for a tow line.

Where hose must stand abrasive conditions, use a wire-wrapped design.

Prevent kinking, dragging across gravel, broken stone, or around sharp corners of equipment.

Don't let trucks or other heavy objects pass over hose and crush it.

Where possible avoid pulsating pressures in a hose.

Store hose in a cool, dry, well-ventilated place and properly support the hose coils.

Don't hang hose on radiator or boiler.

Arrange valves and other pipe fittings so that hose will connect to them from below and hang down. When top connections are made a sharp bend is put into the hose where it hangs down, seriously shortening its life.

WATER HOSE

▶ MANY OF THE SUGGESTIONS for air hose apply to water hose.

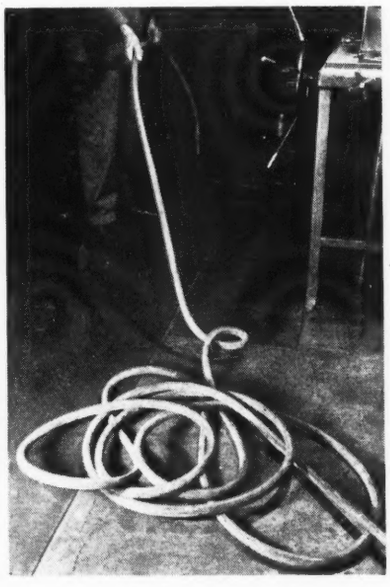
Don't use hose for pressures higher than that for which it was designed.

When you want to stop the flow, don't kink the hose—close the nozzle or the shutoff valve on the end of the hose.

Don't let hose remain under pressure when not in use.

Avoid sharp bending and flexing of the hose as much as possible.

Don't pull kinks in empty hose when getting it into position for use.



Unroll, don't pull kinks in a hose when getting it ready for use in the plant

Drain water from hose when not in use to prevent water penetrating reinforcing cotton fabric. Store on a reel.

Don't use hose of greater length than necessary for the service, as a long hose wears out as quickly or faster than a short one.

STEAM HOSE

▶ DON'T USE HOSE on higher pressures and temperatures than those for which it was designed.

Where hose must be subjected to excessive temperatures, use designs with a woven asbestos cover.

Use wire-wound hose for high pressure as a safeguard against expansion and excessive bending.

Drain hot water from hose after using.

When hose is used for steam service leave free end open when shutoff valve is closed or steam will condense, create a vacuum and cause the hose to collapse.

For washup service around oil refineries, packing plants, creameries, and for similar services, use hose designed for this work.

Wash outside cover of washup hose daily if used in greasy conditions, or get synthetic-rubber hose.

FIRE HOSE

▶ UNPACK NEW HOSE as soon as received and loosen coils to relieve strain on inner tube.

Change position of hose periodically when it is stored on racks, to prevent continuous strains at the same points in the inner tube.

Dry hose after it has been used, to prevent mildew.

Where mildew is likely to occur, use a mildew-proof hose.

Protect the hose jacket from acid, gasoline or other fumes.

If jacket comes in contact with acid, wash with a 5% solution of washing soda and then finish with a thorough washing in plain water.

Make sure that standpipe valve does not leak into hose and cause dampness and mildew in warm weather and freezing in winter.

Clean hose thoroughly on outside if exposed to oil when in use.

If hose jacket becomes damaged, drain and dry, then apply rubber cement, shellac, varnish or other water-repellent solution to prevent the fabric unravelling and weakening the jacket.

Use shutoff valve to stop flow from hose, don't kink it. Kinking will damage rubber

HOSE COUPLINGS

▶ USE PROPERLY DESIGNED and approved couplings and other attachments suitable for the pressure they must stand, and make sure they are securely connected to the hose with the correct tools. On steam and air lines failure of these fittings is a serious accident hazard.

Use couplings free of burrs and sharp corners.

Put rubber cement on coupling stem and inside hose end before assembly.

Don't let cement dry before assembly.

Don't cut inside tube of hose to fit a coupling on nipple stem.

Use couplings and other fittings with proper size stems.

Don't turn down coupling stem in a lathe if it is oversize for hose.

On wire-wound hose be sure that end of wire is held firmly by hose-coupling clamp.

Use clamps of such a size that they have space between their lips for future takeup.

On steam and air use a coupling that can be retightened after it has been in use for a time.

Force the hose by hand firmly and squarely over the fitting sleeve while holding the fitting in a vise.

MISCELLANEOUS

▶ MUCH OF WHAT HAS BEEN SAID about protecting belts and hose against abuse applies to other less commonly used rubber materials, such as mats, tank linings, clothing, etc. Most of this sums up to: use good old-fashioned common sense in the application and care of these materials and you will do the right thing in most cases.

Rear Arch Improves Underfeed-Stoker Operation

Citing field experience, D J Mosshart, Westinghouse Electric & Mfg Co, shows how rear arch betters combustion at high ratings, particularly with "drifting" coals, and gives data for satisfactory wall designs

▶ EXTENDED SERVICE in some 20 plants indicates that application of rear arches to underfeed stokers definitely improves combustion at high ratings and, where "drifting" limits capacity, may yield a 15–20% gain in output. Although a recent development, the rear-arch furnace wall has undergone sufficient trial in the field to warrant thorough consideration in the design of a new installation or the rebuilding of an old one for improved performance.

The functions of the wall as originally intended and as demonstrated in practice are:

1. To deflect and direct lean gas (with high excess air caused by infiltration around ash-discharge plates) forward over the fuel bed so that the air in this gas may be used to accomplish quicker burning of the richer gas arising from the central portion of the fire. This permits higher capacity smokeless operation with greater ease.
2. To redirect over the fire a sufficiently large proportion of the products of combustion at a velocity high enough to create turbulence in the furnace atmosphere and to throw the fly coke and flyash present in the furnace gas at high combustion rates forward to the higher parts of the furnace. In this latter area gas velocities are relatively low and the change in direction of flow causes a considerable part of the suspended matter to precipitate to the fuel bed.
3. To prevent "drifting" during operation at high combustion rates with coals which tend to "blow" from the fire to the extent that drifts of blown fuel accumulate in the ash-discharge area.

Operating data summarized from available observations shows that under similar conditions the rear-arch furnace provides smokelessness at 15% CO_2 equivalent to that of a straight-wall furnace at 14%.

Furthermore, the rear arch reduces carbon content of flyash by about 25%. Because underfeed stokers discharge relatively small quantities of flyash, accurate comparison of the total quan-

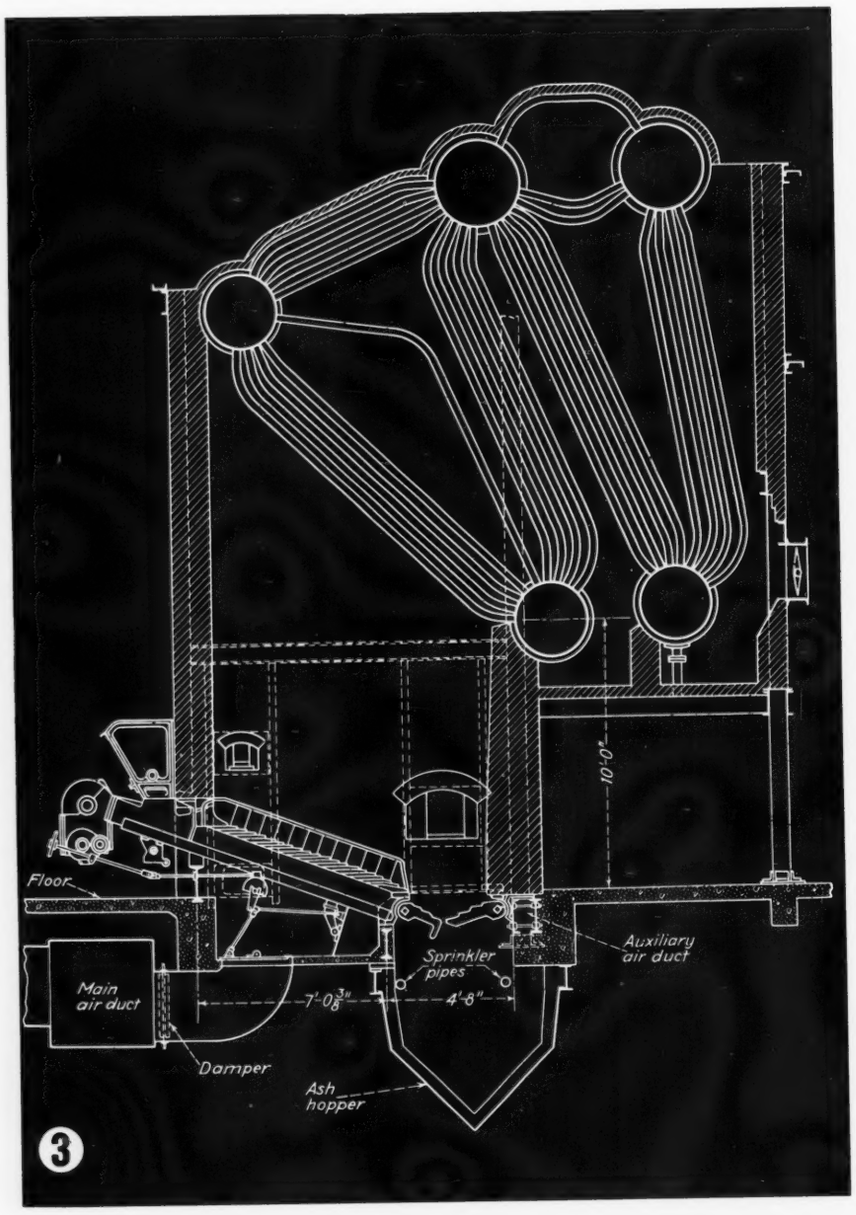


Fig. 3—Before modernization, an underfeed stoker fitted with conventional dump plates fired this bent-tube boiler. The vertical bridgewall was not water cooled. See Fig. 4 (right) for changes made to improve combustion and increase capacity

tity discharged has not been undertaken. Chemical analysis of the material caught in the boiler soot hoppers offers a fair indication of considerable reduction in combustible content.

The rear-arch wall, properly proportioned, positively prevents drifting and where this limits capacity may increase output by 15 to 20%.

Figs. 1 and 2 show the two types of wall so far employed. In Fig. 1, the wall has a horizontal portion extending over the stoker, in Fig. 2 the wall is simply inclined forward. Either construction may be employed with equivalent results; choice usually depends on structural limitations. In general, the construction shown in Fig. 1 is easier to apply, keeping within the limits of proper design ratios.

Because the wall really functions as the combined upper defining wall of a gas chamber and as a nozzle, its effect depends on the length of grate covered by it (which determines the quantity of gas redirected) and the distance between the wall and the grate at the forward extension of the wall (which determines the velocity of gas discharged forward from the wall). A line x–x, of length *A*, normal to the grate surface, defines the nozzle opening. A line y–y, of length *B*, parallel to the grate, defines the length of grate served.

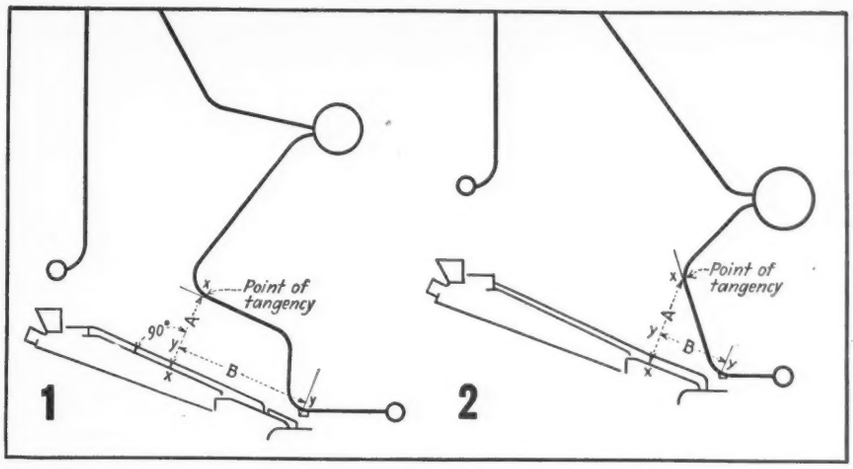


Fig. 1—Rear arch with horizontal section over fuel bed, usually easiest to apply.
Fig. 2—Inclined rear arch. Both work well; choice usually rests on structural needs

If *A* and *B* are measured in feet, and the fuel bed is assumed to be one foot thick (which it is, usually) then the relative velocity at line x–x is indicated by the ratio $\frac{B}{A\text{-}1}$. Field experience with various ratios guides in selection of one which is reasonably certain to enable realization of maximum benefits.

Ratios of installations in operation range from 0.9 to 2.1. Smaller ratios prove only slightly effective while maximum ratios have not had sufficient service to warrant judgment. Present indications favor a ratio of about 1.4 to provide adequate effect without undue structural difficulties. It is preferable to obtain the desired ratio by keeping *A* as short as possible (usually location of side furnace doors is the limiting factor) so that *B* does not become unduly long. This keeps velocity through the throat between the front wall and the forward end of the arch relatively low to prevent re-entrainment of fly coke and flyash in the gas stream.

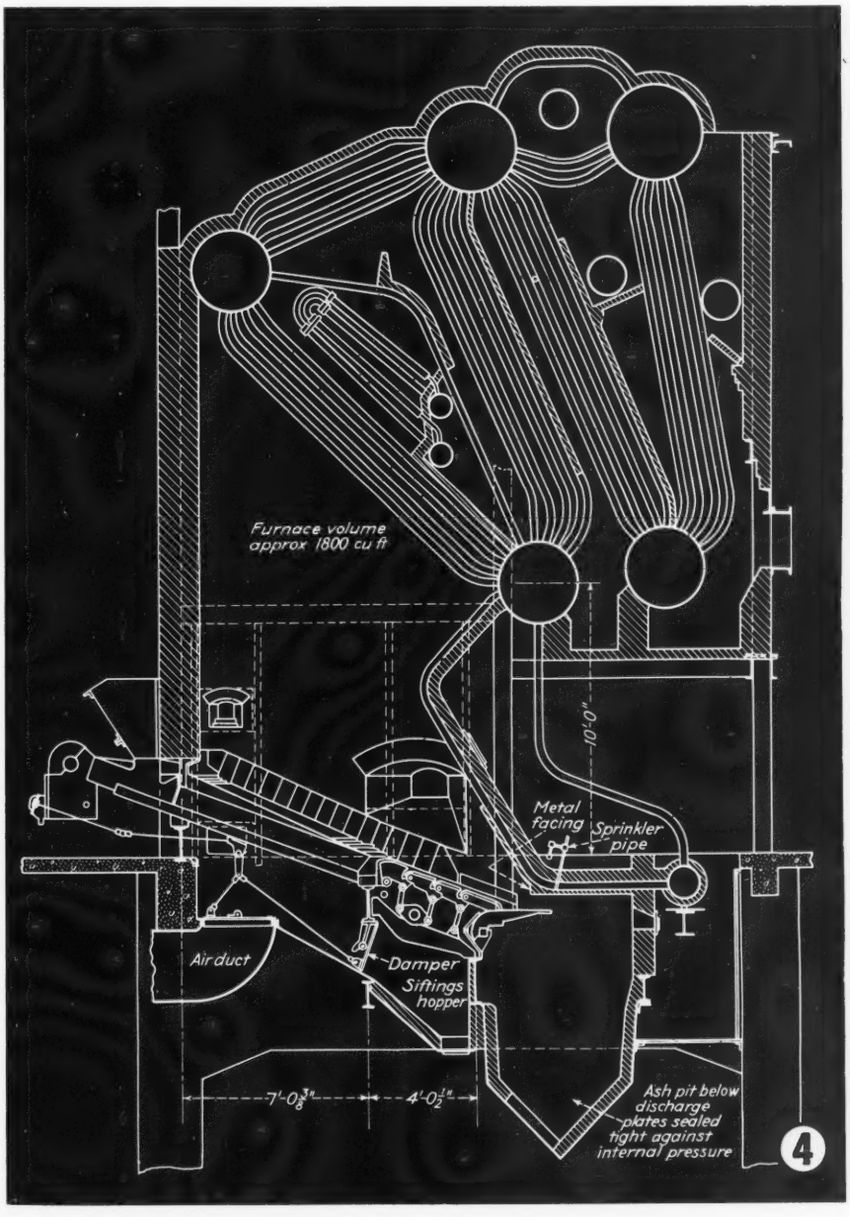
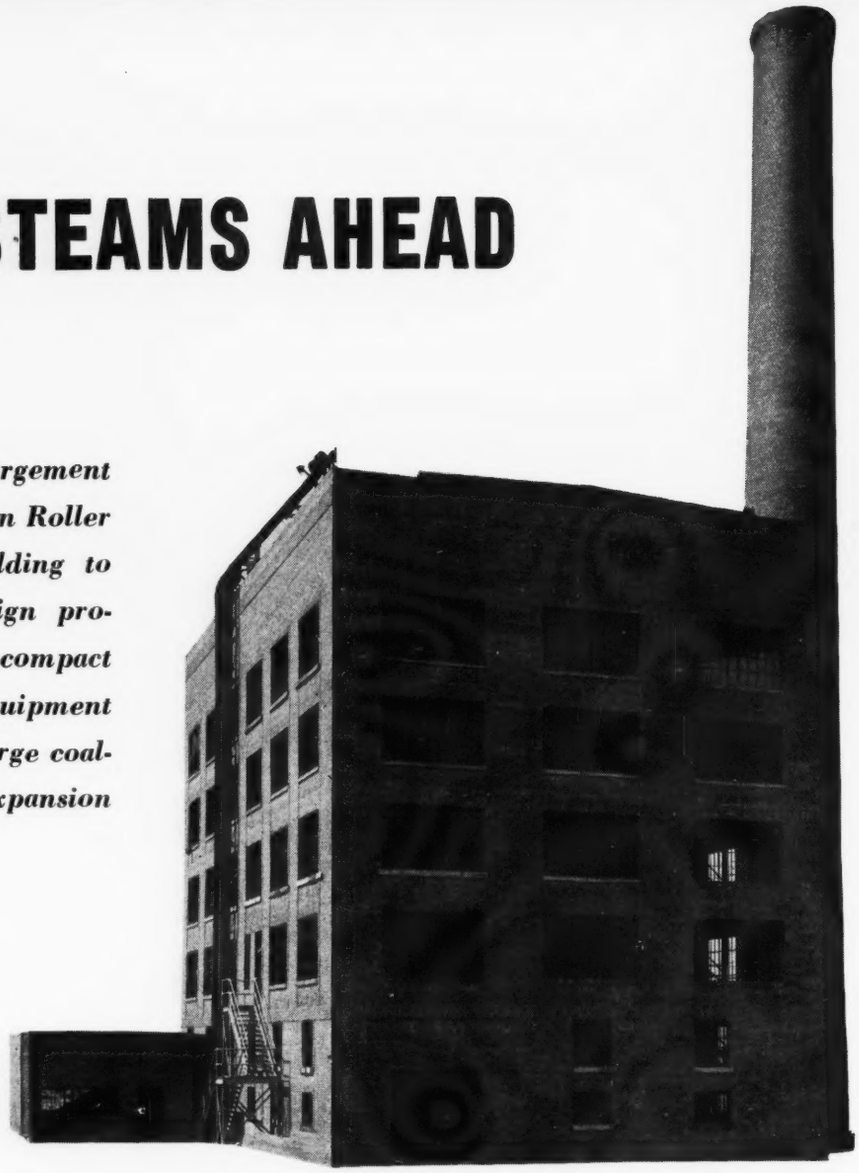


Fig. 4—Replacing the vertical bridgewall with a water-cooled rear arch improved combustion conditions and permitted installation of a Link-Grate section with continuous ash discharge, substantially increasing active grate area and output

TIMKEN STEAMS AHEAD

With only limited space for enlargement of the present plant, the Timken Roller Bearing Co erects a new building to house additional boilers. Design provides for convenience as well as compact arrangement of all auxiliary equipment and location allows room for large coal-storage area and future plant expansion



▶ The Timken Roller Bearing Co will soon place in operation a new boiler plant incorporating the latest refinements in steam-generating equipment. Expanding operations to meet the ever increasing demand for bearings required additional steam for processing and heating. No electric generating machinery will be installed as the factory operates on purchased power.

The new plant provides reserve capacity above the present peak requirements, yet permits efficient operation during low seasonal demands. Although adequate for present conditions, lack of space prevents any additions to the present plant, as factory units have gradually expanded and now surround it completely. Choosing another location not only made future expansion possible but also provided a large and convenient area for coal storage. Having their own water supply from drilled wells, although city water is available, permitted a location 1200 ft from the present boiler room. To allow for pressure drop in this line the new boilers will operate at 225 instead of 160 psi, as carried on the present plant. Moving to the new location required the additional expense of a new building and stack, but the advantages gained more than overbalanced this cost.

The new plant arrangement is similar to the present plant which was erected in 1918. At that time two Heine boilers complete with stokers were installed, but increasing load required the addition of two Stirling boilers in 1919. In 1923 another Stirling boiler and Taylor stoker were added. In 1937 load requirements were such that larger Taylor stokers were installed on the four older boilers. A bucket elevator carries the coal to a 450-ton concrete storage bunker. Flue gas is discharged through two brick chimneys, 200 and 175 ft high, respectively. Feedwater is treated in a zeolite system and pumped to the boilers with turbine-driven feed pumps. Forced-draft fans are 7 x 10-in. Clarage vertical steam engine driven.

New Plant Equipment

Local run-of-mine strip coal with a heat content of 13,300 Btu can be delivered to the plant by rail or truck. Coal from the adjacent storage pile is trucked to the track hopper where it passes over an apron conveyor to the crusher. After the coal is crushed a skip hoist raises it to the roof and unloads on an inside drag conveyor. From here it is transferred to the two 100-ton steel brick-lined storage tanks. On leaving the tanks its weight is registered by automatic scales before passing through Stock chutes to stoker hoppers.

Eight-retort Taylor stokers fire waterwall furnaces on two Stirling 4-drum 90,000-lb-per-hr boilers, permitting flexible operation for large variations in load between summer and winter. The new building, 60 x 104 ft, 75 ft high, with a 165-ft radial brick chimney 10 ft 10 in. diameter at the top, is of steel and brick construction with interior walls of salt-glazed tile. Coal and ash storage tanks are located inside the structure. Each stoker is equipped with integral variable-speed turbine drive. Cooling tubes are installed on the tuyeres and beneath the retorts. Dropping from the lower drum along the side walls to a header beneath the stoker, two tubes pass full length of each tuyere row and up the front wall to expansion bends before entering the top front drum. From this same header additional tubes follow the retort passage to a boxheader mid-length of the

Fig. 2—Firing aisle in the present plant with all equipment located in the operating area, permitting close supervision

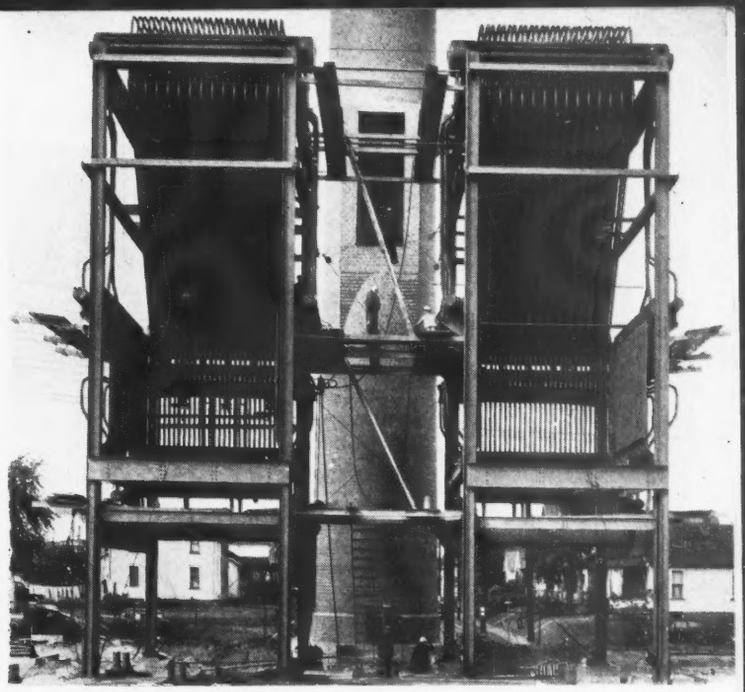


Fig. 3—Boiler erection ahead of building construction gives unobstructed view of furnace waterwall tubes in place

retort. Other tubes leave this header, continuing along the retort to the front wall, where they rise to the upper front drum. All waterwall tubes are protected along the fuel-bed area by four rows of Bailey armor blocks. From this point up, all walls are of bare-tube construction. Sifting hoppers under the windbox chambers catch small coal particles which pass through the stoker bed; from here they are blown back to the furnace by steam-jet conveyors controlled by motor-operated valves.

Ash discharge is continuous to hoppers in the basement at ground level. From this point ash is carried to the tile storage tank by a steam-jet conveyor. Located inside the plant, this tank is equipped with air washers to prevent ash dust being exhausted into the building. A chute from the tank through the building wall permits convenient loading of the ash to trucks.

A typical analysis of the well supply for feedwater is as follows: bicarbonates 349 ppm, calcium 106 ppm, magnesium 23 ppm, hardness 359 ppm, pH 7.0. As condensate from process goes to waste, makeup requirements average 90% in summer; in winter when heating condensate is returned, makeup is reduced to about 30%. All makeup water is treated by the hot lime-soda process and filtered to reduce its magnesium and calcium content; oxygen and carbon dioxide are removed in a deaerating heater and softener. Consistently following a practice of testing the boiler water for chlorides, oxygen, and alkalinity at 4-hour intervals has resulted in the record of only eight tubes being replaced in the present plant since 1920. Tubes are turbined once a year in comparison to every ten days prior to 1920. Correct water treatment and a close check on its operation has been responsible. Water-conditioning equipment is checked at 2-hour intervals.

Feedwater Treatment

Condensate from the heating system flows by gravity to motor-driven centrifugal pumps which return it directly to the deaerating section of the heater. All auxiliary turbines are designed to operate at 5 psi backpressure to furnish steam for heating and deaerating the feedwater. Well water for makeup is supplied to the deaerating heater and softener by the booster pumps, one of which is motor and the other turbine driven. Lime and soda solution is added at this point and the water then passes through anthracite filters on its way to the boiler-feed pumps. Phosphate treating equipment is arranged to permit feeding directly to the boiler drums or to feed-pump suction. One motor- and two turbine-driven feedwater pumps are constant-speed units with feedwater flow controlled by Copes regulators.

Continuous-blowdown discharge enters a flash tank piped to discharge directly to waste or to a heat exchanger where its heat is extracted by well water passing to the feedwater supply.

Automatic combustion control to maintain a substantially constant steam pressure is provided by a master unit regulating a pneumatic loading pressure transmitted to a relay for each boiler. Each relay is equipped with a manual-to-automatic transfer valve. Individual boiler combustion rate can be advanced or retarded without disturbing the automatic functions of the control system; it also permits either boiler to be placed on manual operation. Loading pressure from each boiler relay operating through pressure-differential measuring devices controls the uptake damper. This same boiler relay actuates the fuel-control relay to vary the stoker feeding rate. A draft-control relay operates forced-draft-fan outlet damper instead of varying the fan speed.

Air for combustion is delivered to the divided windbox chamber beneath the stokers by 31,000-cfm constant-speed turbine-driven forced-draft fans. Turbine exhaust, 2-5 psi backpressure, is piped to the deaerating heater. Fans operate at turbine speed of 1800 rpm; air flow is controlled by the outlet damper. Air pressure in windbox chambers is regulated by individual dampers, giving control of air distribution over the fuel bed. A simple and economical arrangement for emergency power on the forced-draft fans consists of a spare 50-hp electric motor with its base adapted for bolting to the turbine bedplate, only minor alignment adjustments being necessary. This arrangement saves the cost of an additional motor which would have been required if dual drive had been installed on each fan.

Steam load, which varies from 2,840,000 lb per hr in winter to 900,000 lb per hr in summer, will be supplied through a 14-in. underground header 1200 ft long. Paralleling this line is the 6-in. condensate return from the plant heating system. Both lines are of pre-insulated Ric-wil construction and are fitted with Yarnall-Waring expansion joints; the main steam header having three such joints and the return containing two. Both lines are securely

anchored with four concrete anchor blocks. Manholes at expansion joints give easy access for inspection and packing.

All steam and feedwater piping has welded joints. Where screw-thread fittings were required on small lines, the joint was welded after the fittings were tightly screwed together. Welded pipe joints produce lines giving a maximum of service with a minimum of small aggravating leaks that usually appear after several years' service. Steam is metered before it enters the main supply header and also on the branch lines to all auxiliary equipment. Moisture is removed by passing the steam through separators; traps return the condensate to makeup supply.

Choice and purchase of all equipment was directly under the supervision of the company's chief works engineer. The new plant is expected to take care of the load demand for many years.

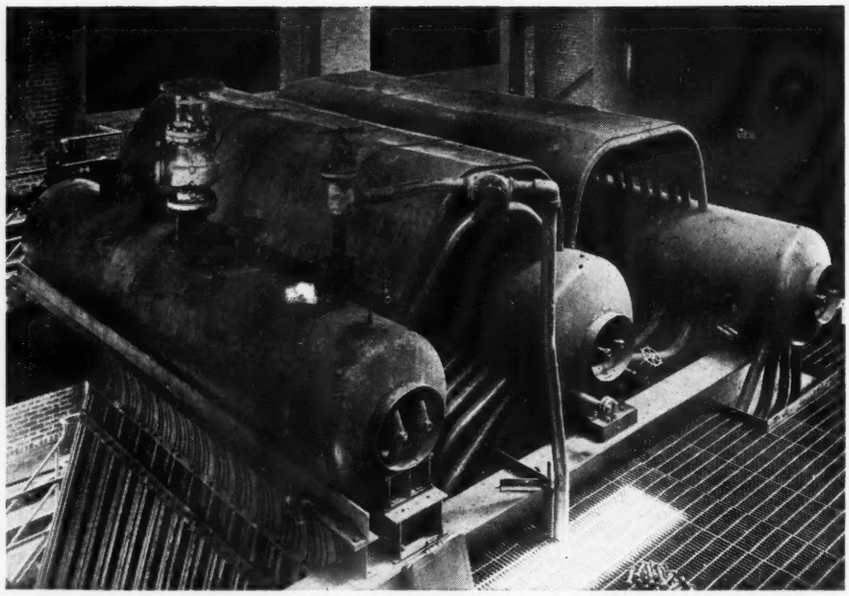


Fig. 4—Boiler drums with welded pipe fittings. Tubes entering extension of front drum rise from furnace waterwall header. Coal-storage tank in background

Principal Boiler-Room Equipment

The Timken Roller Bearing Co

Consulting Engineer — W D Spengler
Building Contractor — Gibbons Grable Co
Steel Erector — Rohe Construction Co

Structural Material:

Steel floor grating — Blaw-Knox Co
Building brick — Metropolitan Brick Co
Salt-glazed tile for inside walls — Stark Brick Co
Metal sash and doors — Baily Springfield Co
Hand railing — Ornamental Iron Works
Cement — Diamond Portland Cement Co
Structural steel — Bethlehem Steel Co

Steam-Generating Equipment:

Boilers, 2, Stirling 4-drum, with waterwalls — Babcock & Wilcox Co
Boiler heating surface 10,038 sq ft; waterwalls 1423 sq ft; furnace volume 4720 cu ft; heat liberated 23,200 Btu per cu ft per hr; steaming capacity 90,000 lb per hr at 225 psi saturated
Boiler and furnace settings — Babcock & Wilcox Co
Boiler insulation — Johns-Manville
Furnace refractories — Babcock & Wilcox; North American Refractories
Waterwall armor blocks — Babcock & Wilcox Co
Boiler structural steel — Babcock & Wilcox Co
Radial brick stack — M W Kellogg Co
Ducts, breeching and sifting hoppers — Dover Plate & Tank Co

Combustion Equipment:

Automatic control — Hagan Corp
Soot blowers — Diamond Power Specialty Corp
Stokers, 2, Taylor, water-cooled, continuous ash dump — American Engineering Co
41 tuyeres, 8 retorts, 227 sq ft grate area
Stoker drive, integral turbine — American Engineering Co
Coal-siftings conveyor, steam-jet — United Conveyor Corp.
Stoker speed control — Hagan Corp
Forced-draft fans, 2, 31,000 cfm, 4.5 in. sp — Buffalo Forge Co
Turbine drives, 50 hp, 1800 rpm, direct connected — Allis-Chalmers Mfg Co
Emergency induction-motor drive, 50 hp, 1800 rpm — Allis-Chalmers Mfg Co
Fan outlet damper control — Hagan Corp
Air compressor — Curtis Pneumatic Machinery Co

Coal Handling:

Track hopper — C O Bartlett & Snow Co
Apron conveyor — C O Bartlett & Snow Co
Skip hoist — C O Bartlett & Snow Co
Drag conveyor — C O Bartlett & Snow Co
Coal tanks, 2, steel, brick lined, 100 ton capacity — C O Bartlett & Snow Co
Conveyor chains — C O Bartlett & Snow Co
Coal crusher — American Pulverizer Co
Coal valves and chutes — Stock Engineering Co
Coal scales, automatic, 12 tons per hr — Stock Engineering Co
Coal-handling equipment motors — Allis-Chalmers Mfg Co
Coal-handling equipment control — General Electric Co

Ash Handling:

Steam-jet vacuum conveyor — United Conveyor Corp
Tile storage tank 14 ft ID x 27 ft high — United Conveyor Corp
Air washer — United Conveyor Corp

Steam Piping:

Contractor — A C Eynon Plumbing & Heating Co
Insulation — Philip Carey Mfg Co
Welding — Flowers Welding Co
Traps — V D Anderson Co; Warren Webster & Co
Fabricated bends — Grinnell Co
Welding fittings — Grinnell Co
Hangers and supports — Grinnell Co
Reducing valves — Spence Engineering Co
Atmospheric relief valves — Cochrane Corp
Separators — Franklin Power Equipment Co
Expansion joints — E B Badger & Sons Co
Exhaust heads — Swartwout Co
Expansion joints, main steam header — Yarnall-Waring Co
Insulation, main steam header — The Ric-wil Co

Feedwater System:

Water columns — Yarnall-Waring Co
Regulators, Copes — Northern Equipment Co
Continuous blowdown — Cochrane Corp
Boiler-feed pumps, 3, 250 gpm, 800-ft head — Allis-Chalmers Mfg Co
Turbine drives, 2, 90 hp, 3550 rpm, 5-psi backpressure — Allis-Chalmers Mfg Co
Motor drive, 1, 100 hp 3550 rpm — Allis-Chalmers Mfg Co
Booster pumps, 2, 400 gpm, 120-ft head — Allis-Chalmers Mfg Co
Motor drive, 1, 20 hp, 3550 rpm — Allis-Chalmers Mfg Co
Turbine drive, 1, 20 hp, 3550 rpm — Worthington Pump & Mach Corp
Condensate return pumps, 2, 200 gpm, 200-ft head, motor drives, 3500 rpm, 20 hp — Allis-Chalmers Mfg Co
Strainers — Fisher Governor Co
Water treatment, anthracite filters, hot lime-soda process — Cochrane Corp
Bag elevator — Allis-Chalmers Mfg Co
Deaerating heater, 250,000 lb per hr, 60 F to 210 F — Cochrane Corp

Meters:

Feedwater flowmeter — Ring Balance Instrument Co
Steam flowmeter — Ring Balance Instrument Co
Control board — Hagan Corp
Pressure gages, steam — Manning Maxwell & Moore
Temperature recorders — Ring Balance Instrument Co
Draft gages, 2, 5-pointer — Hays Corp

Valves:

General purpose — Wm Powell Co
Non-return stop — Edward Valve & Mfg Co
Feedwater valves — Edward Valve & Mfg Co
Main steam header, 3, motor-operated — Wm Powell Co
Motors and control on steam valves — Cutler-Hammer
Special valves, screwed and flanged fittings — Crane Co
Blowdown valves — Yarnall-Waring Co

Building Services:

Wiring — Hislcher Clark Elec Co
Hot water temperature regulator — Fulton Sylphon Co
Toilet facilities — American Radiator & Standard Sanitary Corp
Hot-water storage heater — Kewanee Boiler Co
Transformers, 300 kw, 2300/230 volt — Westinghouse Elec & Mfg Co
Substation structure — Vern Shear Co

Storage Battery Takes Over When Power Fails

Two 525-amp-hr 96-cell storage batteries at DeLaval Steam Turbine Co take load instantly if normal power service is lost

▶ MACHINING OF MODERN GEARS requires tolerances so close that final hobbing operations cannot be interrupted without affecting the accuracy of the work. Once the final finishing job is started it must be carried through to completion. This operation on some gears may require up to 720 hr depending on their size, emphasizing the necessity of insuring uninterrupted operation. The most likely cause of an interruption is a power failure and in the De Lavel Steam Turbine Co plant in Trenton, N. J., an Edison storage battery provides insurance against this emergency.

Power is normally supplied to the gear-hobber and lubricating- and cutting-oil pump motors at 230 and 115 volts, 3-wire direct current, a load that totals between 17 and 23 kw. As experience had shown that the maximum power interruption that might occur would not exceed four hours, a 525 amp-hr battery was selected, which consists of two 96-cell units, one connected across each 115-volt side of the 3-wire system.

Emergency power is controlled so that it is transferred to the load when normal power fails and switched back to standby again automatically when normal power returns. These transfers must be made almost instantaneously, so that the voltage will not drop below 111 and 222. Battery charging is varied automatically, from trickle rate during standby to more than normal if necessary following an emergency discharge, by control of generator field current.

The discharge rate of one battery may be faster than the other. This is provided for in the control, and either battery may be charged at a higher rate than the other, automatically, by two 5-kw 50-volt shunt generators, one connected in series with each battery. These generators are driven by a 15-hp 230-volt motor operated from the normal power supply during standby service and from the battery during emergency service.

The motor-generator operates as a balancer set on a 3-wire system to compensate for unequal loads on the two sides of the system. During charging the generators boost line voltage as required by the charging rate and on discharge the generators either buck or boost the battery, as needed to maintain constant voltage at the load. Voltage is held so constant by the General Electric automatic control that the machine operators cannot tell if power is from the normal source or from the standby batteries.

Transfer contactors on the control are actuated by undervoltage relays set to open when line voltage drops to 222 and throws the load on the battery. When this happens current direction through the batteries and generators reverses. As a result the generators, which had been boosting line voltage, begin bucking the battery voltage to hold it constant at the load. If on prolonged discharge, the battery voltage drops below 115, current in the generator field windings is reversed so as to begin boosting the voltage. On resumption of normal 230-volt power the transfer contactors reverse their position to return the load to normal power supply and put the battery on charge.

Standby power equipment includes two 525-amp-hr 96-cell storage batteries, a motor-generator set for charging and boosting, and automatic control equipment

Battery control panel with relays, meters, contactors and voltage regulator

Save Time by Machining Turbine Shaft

A job ordinarily requiring weeks was completed in days by making and adapting a tool to fit the job. This article explains a quick method using 25-cycle power to motor a 60-cycle generator at low speed for machining the shaft

Fig.1 Dismantling avoided by machining the shaft in position with portable tool

▶ THE 24-IN. SHAFT OF A VERTICAL hydraulic turbine was found badly corroded 30 in. under the bronze guide-bearing journal sleeve, resulting in a loose fit between the sleeve and shaft. The turbine drives a 15,000-kw 94.7-rpm 60-cycle generator and removal of the shaft would have been costly, besides requiring extended outage. To avoid this, preparations were made to machine the shaft in position using an improvised lathe tool. Revolving the shaft at the desired speed presented a difficult problem; although only a small amount of power was needed, the job required a torque of 4800 ft lb.

Local conditions prevented the installation of a satisfactory motor drive, and although another 60-cycle unit was installed nearby, higher operating speed made it more convenient to use 25-cycle driving power. The higher speed of the 25-cycle machine permitted much better group control. No trouble was anticipated from operating the thrust bearings at low speed, as this had been done successfully many times before.

Adjacent to this unit is a 12,000-kw 116-rpm 25-cycle generator available during off peak hours to motor the 60-cycle generator at low speed. The terminals of the two generators were connected by temporary cables, the field of each machine was energized from a constant potential source and both units started by admitting water to the turbine of the 25-cycle unit. Both machines came up to speed together. Several attempts to drive the 60-cycle machine at 8 or 9 rpm were unsuccessful, because it fell out of step after 15 to 20 seconds. The speed was then increased to 12-13 rpm, and no further trouble was experienced. The corresponding speed of the 25-cycle unit was 36-39 rpm. Field currents required, in percent of full-load, were: 25-cycle machine, 50%; 60-cycle machine, 80%.

Wicket-gate opening on the driving unit was controlled by the hydraulically operated, hand-controlled system, and once adjusted required no further attention except to guard against a drop in speed below 10.5 rpm, at which the two machines would fall out of step.

in Position

F I MORGAN
Pennsylvania Water & Power Co, Baltimore, Md.

The lower end of the shaft was held in a triangular frame *F* of heavy angle iron bolted to the bearing support. Three adjustable shoes *S*, of 6x6-in. oak block faced with ¼-in. brass plate, 120 deg. apart and bearing against the shaft, were mounted on this frame and backed up by screw jacks *J*. Lubrication was supplied through connected grease pressure piping. A small misalignment between the steady rest bearing and the generator guide bearing prevented shaft oscillation. A dial indicator, bearing against a true section of the shaft in view of the machinist, provided a constant check against any change in position while the work was in progress.

No difficulty was encountered in removing metal at an average shaft-surface speed of approximately 80 fpm. A high-speed-steel cutting tool was used, and a satisfactory finish was obtained over the entire machined area. Fillets at the end of the turned section were given maximum radii to produce a gradual reduction rather than a sharp change in shaft diameter.

Tool Has Many Uses

The lathe tool was designed and constructed in the plant machine shop. Longitudinal ways machined on a substantial base plate carry the movable tool-rest block. Guide bearings on the base support the lead screw. The tool rest is movable over guide ways cut on the tool-rest block, making possible tool movement in two directions at a 90-deg angle. An extended stem and handwheel permits installing the tool in close quarters. The V-shape sliding ways, similar to those on regular lathes, provide accurate movement and reduce lost motion of the cutting tool. Although all advantages are retained in the tool, it is small and compact, allowing it to be used in confined places. Its portability and ease of setting up makes it adaptable for many machining operations. On a job of this kind, where the dismantling operation is eliminated, the cost of the tool is a very small part of the total.

After completion of the machine work a 62-in. spare bronze journal sleeve was installed. As the metal was removed for only half the sleeve length shims were necessary. To compensate for the metal removed from the shaft, sheet-brass shims a few thousandths of an inch thicker than the metal removed were used as a filler between the sleeve and the newly machined part of the shaft. Two such pieces, each slightly less than one-half the shaft circumference, were installed with the ends butted coincident with the joints in the sleeve. Bolting the halves of the sleeve together drew the shims snugly and clamped the sleeve solidly to the shaft. After two months' operation the sleeve was found to be in perfect condition with no evidence of sleeve or shim movement on the shaft.

Fig. 2 A 3-point guide, with grease lubrication, bolted to the bearing support and backed by screw jacks, provided a steady rest for the shaft during machining operations

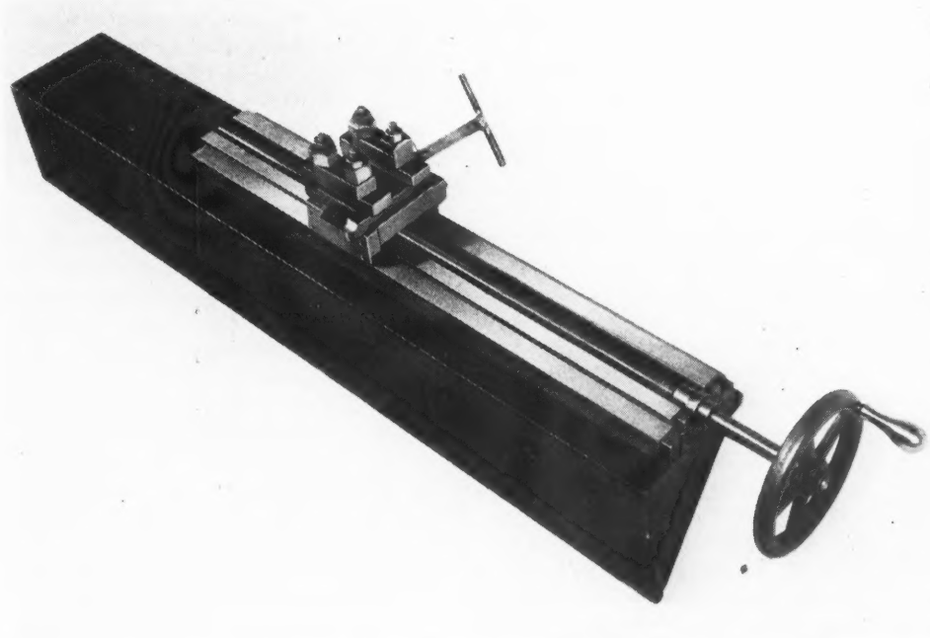
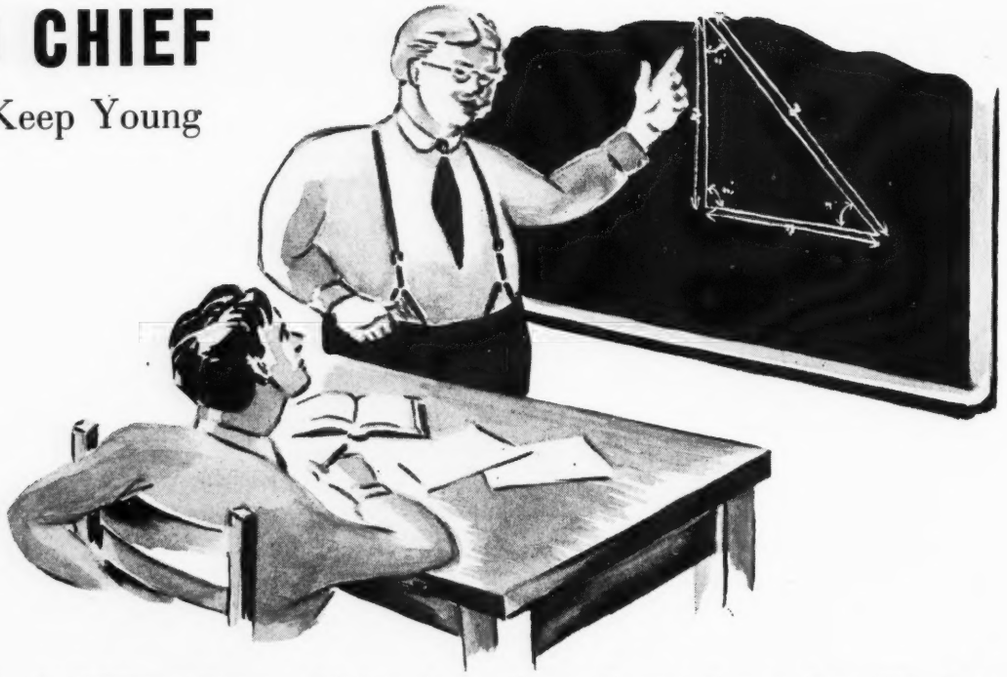


Fig. 3 Small compact feeding device is easily constructed in the plant machine shop

THE OLD CHIEF

19—How to Keep Young



Another in the series by William Doran, chief engineer, Essex County Sanatorium, Windsor, Ontario. Writing of the inspiration of the past, he has captured much of the human side of engineering that lies beneath the maze of power plant costs and the wavy lines on paper disks

▶ IF SOMEONE WERE TO ASK ME to prescribe the easiest way to grow prematurely old, I would advise them to take only a mild interest in their job, to avoid all trade magazines and trade associations, to just scan the headlines of the evening paper and to go to bed early. Above all, they should avoid all chance of being trapped into any social or community effort that might interfere with their evening doze or peace of mind. I am prompted to give this advice from a long study of my friend, the Old Chief, and his ways.

I have often heard it said that as a general rule, a man receives from life a sum that is in a just proportion to that which he puts into it. Few men received more out of life than the Old Chief, and few men that I have known put more into it than he did. He was a loyal member of an engineering association, a regular service club man, a high-ranking officer in a fraternal order, treasurer of the lawn bowling club, president of the local horticultural society and a willing worker and booster for each and every community effort. Strange to relate, while he may have put on a little weight here and there, *he never grew old.*

In addition to all his activities, he was at all times willing to help the junior engineers with their studies and to afford them encouragement by his kindly interest. I recall one of the many occasions when I sought his assistance in solving a problem that I had encountered in my studies. The average man would have brushed me off with a five-minute talk on the principles involved, and let it go at that. Not so the Old Chief.

Triangle Calculations

As the question involved the relation of one side of a triangle to the others, he not only worked out the problem for me, but gave me a lot of similar problems to work out for myself. When I apologized for taking up so much of his valuable time, he laughed. "Why," he said, "I ought to thank you for the opportunity. You know, *when you row the other fellow across the river, you take yourself across at the same time.*"

A large majority of the engineers I knew in the old days were men of few words. In fact, to those who had no business in the power house, we must have appeared to be a bunch of boorish, surly, uncommunicative people. Now and then a blattering chattering monkey of a man would crop up among us, but invariably, in a short time, he would crop down again.

I remember an occasion when we were looking for a capable operator to handle the big corliss and act as foreman on the night shift. From the applications the Old Chief found and interviewed a man who had first-class experience, on paper, at least. The Chief took him around the plant, and started to explain our stoker setup and our way of maintaining the pressure line.

He was quickly interrupted by this bright applicant, who told with all the details, how he had "bawled the heck" out of the field representative of our stoker manufacturer, and how he had made their experts look like a bunch of "nitwits," by fixing the stokers after the experts had given up.

A little further on an attempt was made to show him how we started up the big synchronous motor, a job which was not done just by pushing two buttons and turning a handle. While this was being explained to him, he again interrupted to hold forth on a description of some bigger and better job that he had run, and to tell us how he had "jumped all over" a "big shot" power-commission man, who thought he could tell him "where to head off at."

While he talked and talked I noticed that the Old Chief was steering him towards the door. "Good-by, sir," said the Old Chief, "you are far too good for us; we could never live up to you." Glancing at his watch he remarked, "Darned smart boy that. Talked himself in and out of a good job inside of ten minutes."

Many years afterward I reminded him of the incident. He smiled and said that it was his considered opinion that *a man's ability as an engineer varied in inverse ratio to his loquaciousness.*

Your Manila Rope—Nurse It Carefully

Present stocks of Philippine fiber must last for the duration. Care for rope you now have and intelligent use of substitutes will get you by safely, reports W E Rossnagel, Consolidated Edison Co of New York

▶ BECAUSE MANILA FIBERS are stronger than those from other sources, and because America has long been accustomed to nothing but the best, we face a considerable and not too pleasant change in our use of rope for hoisting and general utility work. Manila substitutes will require lower rope loadings, more frequent inspections and, above all, a working knowledge of the characteristics of the several types we will have to use for the duration.

For thousands of years man has used vegetable fibers for lifting loads. At first, vine stems twisted together formed crude strands that were flexible and could be tied in knots. Later developments utilized fibers of palm-tree bark, the hair of the cocoanut, camel hair, horse hair, thongs cut from hides, cotton, wild and cultivated hemp, and manila, obtained from the abaca or wild banana grown in the Philippines.

Unlike wire rope, produced synthetically to the exacting specifications of the metallurgist, with known composition, strength and modulus of elasticity, all vegetable fibers vary in quality. Their strength depends on climatic conditions, fertility of soil, cultivation and curing.

Rope Construction

Fibers from the outer portion of the abaca stalk are darker, lower in strength and less durable than those from nearer the center. Sorted into grades according to color, hanks are cut to about 7-ft lengths and combed in a drawing frame. To lubricate and preserve the rope, cordage and other special oils are applied to the fibers during the combing process.

A group of fibers, twisted into a *yarn*, forms the unit of rope construction. A number of yarns are twisted left handed into a strand, three or four strands laid right handed make up a finished rope. If the strands are tightly twisted the rope is *hard-laid*, stiff and resistant to abrasion. More loosely twisted *soft-laid* rope is stronger.

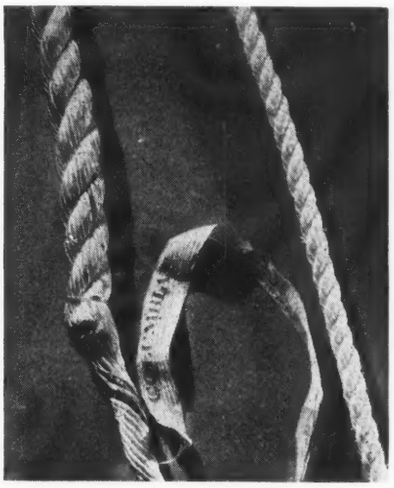


Fig. 1—Java sisal has about 75% the strength of manila fiber, but stocks of this substitute are limited. Yucatan and Mexican fiber, 65% as strong as manila, require frequent inspection for safety

Manila rope of best quality is light yellow with a silvery lustre and a smooth waxy surface. First-grade rope for hoisting usually displays a colored strand, string or paper ribbon as a manufacturer's trademark.

For most purposes, manila rope is made up of three strands. Where abrasion is a factor, a rope having four strands laid around a core is recommended. The latter is more nearly round in cross-section and, although its strength is somewhat less than 3-strand rope of the same size, is used extensively for power hoisting. Up to 1-in. size, a rope is called by diameter. Larger sizes are called by the circumference, assumed to be three (not 3 1/7) times the diameter.

Proper care in opening and storing adds to rope life. It should never be kept on the floor or in a box or locker where air circulation is restricted. Before being used and between periods of actual service, rope should be stored on wood-grating platforms six inches or more above the floor or hung in loose coils on wooden pegs. It should be protected from the weather, out of the rays of the sun and away from boilers, steam pipes and other sources of heat that cause oil to dry out of the fibers. On the other hand, it should be kept away from dampness or moisture. If a rope has become wet, it should be hung up to dry and not allowed to freeze, which seriously injures fibers and reduces strength.

Avoid Damage

Care in opening new rope avoids hockles and kinks. Pulling out kinks causes severe damage to rope. When rope is cut, yarn or cord whippings should be applied at once to prevent the strands from becoming unlaid. If one strand slips with relation to the others, load will be unevenly distributed and rope life will be shortened.

When attaching a rope to a hook, ring or pulley block, a thimble should be placed in the loop or eye to reduce wear on the rope and decrease stresses developed in the rope from bending around a small diameter. When used as a sling, the rope should not pass over sharp edges of castings, boxes or beams unless a padding protects the rope. Also, rope should not be dragged over concrete, or through sand or cinders, as the outside surface may be worn or cut by the abrasive action. Small particles of gritty material allowed to get between the component parts of the rope cause internal damage.

Moisture hastens decay and tends to cause kinking. Guys between fixed objects outdoors should be slacked off when it begins to rain, otherwise the shrinkage may overstrain the rope and damage it. Acids, chemicals and many fumes are harmful to rope.

While the foregoing represents common-sense care of good rope in normal times, such precautions now become doubly important to get maximum life out of first-quality rope now on hand or reasonably satisfactory performance from substitutes. Priorities have cut off

Table I—Safe Working Loads in Pounds

Diameter of rope — in.	Manila	Sisal
3/8	135	88
1/2	265	172
5/8	440	286
3/4	540	351
7/8	770	500
1	900	584
1 1/8	1200	780
1 1/4	1350	877

Instead of	3/8-in.	manila	use	1/2-in.	sisal
"	1/2-in.	"	"	5/8-in.	"
"	5/8-in.	"	"	7/8-in.	"
"	3/4-in.	"	"	1-in.	"
"	7/8-in.	"	"	1 1/8-in.	"
"	1-in.	"	"	1 1/4-in.	"

the supply of manila rope for normal uses. Manufacturers are offering a half-and-half rope of manila and sisal and also rope made of pure Java sisal. How long either of these will be available is problematical.

Best sisal ropes have a strength about 70-75% of first-grade manila. Their fiber is whitish, rather coarse and brittle so that the rope feels harsh to the touch. Sisal is most familiar as a whitish wrapping cord sometimes used for express packaging.

The lower strength and more rapid depreciation of sisal rope provide a forced incentive to get the longest possible service from present stocks of manila. One suggestion offered is that of reserving manila for scaffold work, bos'n's chairs and special rigging jobs where human life or valuable equipment is in danger.

Storage and Inspection

Another practical recommendation is that rope now in stock or "in blocks" should be stored under best possible conditions and inspected frequently. Of particular importance is the matter of hanging in loose coils in a dry but not hot location, out of sun and weather.

Periodic inspection, to estimate loss of strength of worn rope, requires more than casual examination. Every foot of the outside yarns should be inspected visually for broken fibers, keeping in mind that every failure represents a proportionate loss of strength. Opening up the rope by untwisting the strands allows observing the internal condition of the rope. Care should be exercised not to kink the strands or otherwise injure the rope. The interior should be as bright and clean as when the rope was new. Don't be misled by dirt on the outside as surface discoloration is to be expected. Internal broken yarns, or a sawdust-like accumulation of powder inside, indicate excessive internal wear between strands.

If the rope is large enough to permit, open up a strand and try to pull out one of the inside yarns. If a rope has been overloaded, the interior yarns will have failed first. Four-strand rope, laid around a heart, shows serious wear when the heart can be pulled out readily in short pieces. Failure of internal strands or heart should be cause for prohibiting use of the rope on hazardous or important work.

Condition of the fibers can be judged by pulling out a couple from the end of the rope. Individual fibers should be broken between the hands only with difficulty. Finer fibers are relatively stronger than the coarser ones.

If the inside of the rope is dirty, if the strands have begun to unlay, or if a rope has lost its "life" and elasticity, it should not be used for hoisting. Such rope will not divide the load evenly among the strands and short life will result.

If the outside surface feels dry and brittle, or shows indication of having been in contact with a hot pipe, or has been discolored by acid fumes, the rope should be discarded. A condemned rope should be destroyed at once or cut up into short hand lines that cannot be used for hoisting.

The same inspection procedures apply to sisal or other substitute fiber ropes, except that the more rapid depreciation expected of the substitutes calls for more frequent checking than for manila. Exposure to chimney flue gas is par-

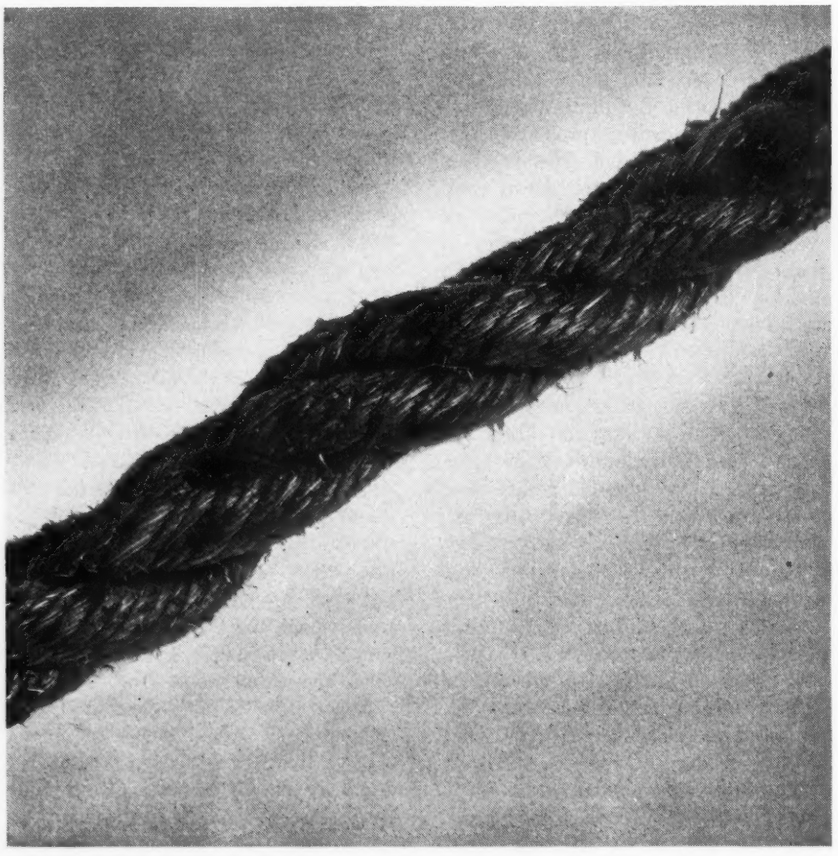


Fig. 2—Broken fibers and yarns are detected by looking for uneven lay which results from too great a share of the load on remaining sound strands

ticularly detrimental to sisal, the fibers of which are brittle and hard to lubricate. Treated sisal rope is not recommended. One rope manufacturer advises 3-strand, regular-lay sisal rope for general use and a grade known as "stevedore rope" where abrasion is a factor. The latter is about 5% "harder" than the regular type.

Since the supply of Java sisal is limited, future rope may have to come from Mexican and Cuban fibers. These have only about 65% the strength of manila. Pending more accurate test information, it is suggested that safe working loads for sisal rope be limited to the values in Table I, calculated at 65% of No. 1 grade manila rope which is also shown for comparison. Both sets of values are based on a safety factor of 10.

Need for high safety factor for rope results from long experience with manila. With substitutes, the temptation to work above set values should be strongly resisted. Many indeterminate factors are thus taken into consideration.

For example, suppose the errors in judgment for a given case should be cumulative. Assume that a weight estimated at 2500 lb is to be hoisted on a 5-part ¾-in. manila rope fall, Fig. 4. Since five ropes support the weight, the rope load will be 500 lb, a seemingly safe amount below the limit of good practice as given in Table I.

Few men can estimate weight closer than 10%. If the load actually weighs 10% more than the estimated 2500 lb, the rope load becomes 550 lb. Pulley friction, usually 10% of the static rope tension, increases rope load that amount for each of five pulleys, or 50% on the 550-lb pull. The hauling rope then has a load of 825 lb if the load is lifted slowly and uniformly.

Jerky hoisting is bad practice, but the rope must be capable of handling an unexpected slip or jar. A bad jerk can increase rope stress several times, but a reasonable assumption might be 100%. The actual expected condition *might* produce a load of 1650 lb.

Rope Wear and Tear

From the other angle, the nominal breaking strength of the rope was 4900 lb *when new*, as expected of first-grade rope. Quality varies, however, and while most rope breaks at a load higher than its nominal strength, this particular length might be as weak as 4800 lb. Age and hard service have reduced this initial strength, a few yarns are broken or cut, the rope has begun to dry out and it has become just an average rope as found on any ordinary job. It may have lost 25% of its original strength, that is, its actual tensile value might be about 3600 lb.

One more factor. It is characteristic of rope that it cannot be used without bending over a pulley, around the eye of a hook or into a knot. Any bend subjects individual fibers to additional stress which must be subtracted from the average strength. Bends and knots reduce the strength of rope as much as 50% so that the net load this rope can carry might be as low as 1800 lb.

In this hypothetical example, then, with all the cards stacked the wrong way, a rope that might have a breaking strength as low as 1800 lb might be asked to carry a load as high as 1650 lb, an actual safety factor of only 1.1. Keep in mind the fact that a safety factor of 1.0 means no safety at all, that the rope will break. While this example is the one case in a million, it is by no means impossible and the moral is important: do not reduce safety factor below generally accepted limits. And remember, substitute fibers are less dependable than manila.

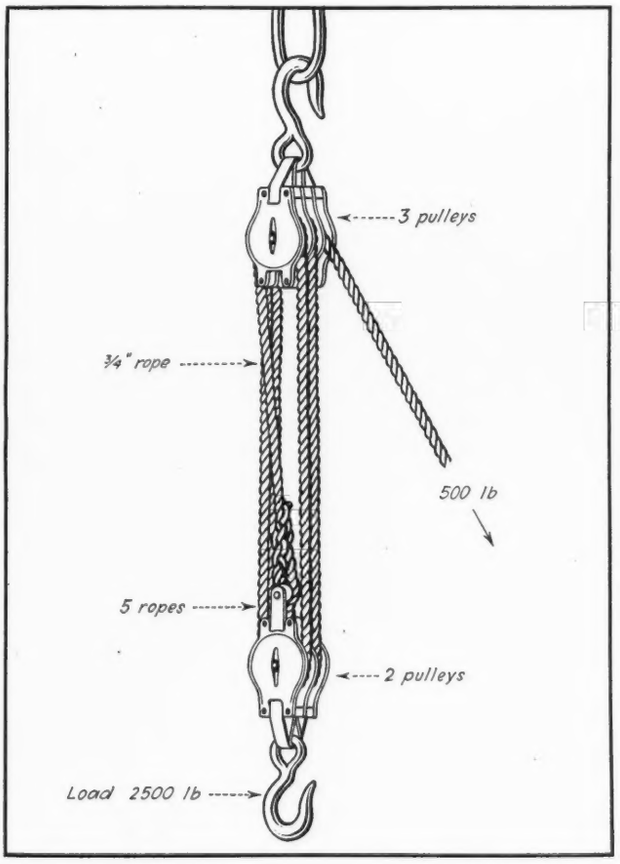


Fig. 4—More wheels in each block mean slower handling but less load on each rope. Rope stress is total load divided by number of supporting ropes plus pulley-friction allowance

Fig. 3—Inspection of every foot of hoisting rope for broken fibers plus occasional untwisting to detect center-yarn failure may save an expensive fall—inspect substitutes frequently

Testing Keeps Turbines Fit

Industrial turbines can be checked regularly without great expense if tests are planned for in advance. W W Johnson, General Electric Co, describes instruments and procedure

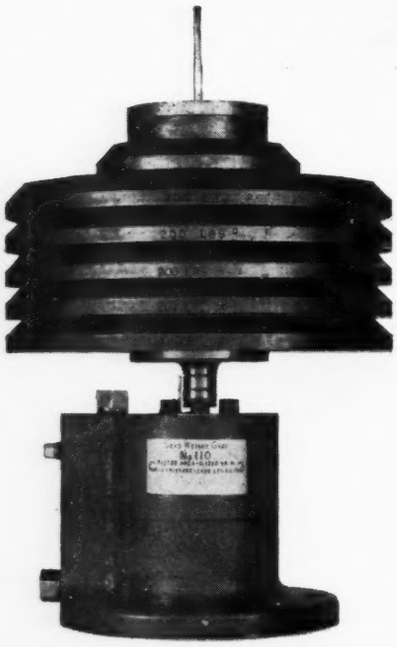


Fig. 1—Dead-weight gage measures pressure to 0.1 psi during test. It also serves to calibrate dial gages in operation

▶ ACCURATE TESTING OF TURBINES under regular operating conditions pays dividends. Not only does the operator want to assure himself that contract guarantees have been met but efficient plant performance requires that the turbine be checked from time to time to see that blade deposits or other undesirable conditions are not robbing the entire plant of top efficiency.

Periodic testing shows when to shut down for overhaul and reveals conditions that may later cause deterioration of turbine parts. Such checks indicate a need for occasional washing or correction of feedwater treatment, or perhaps show a condition causing corrosion during shutdown hours that would otherwise be overlooked. A test also offers an opportunity for the calibration of many station instruments against accurate test equipment.

Where new installations have been planned to include provisions for testing, special equipment and instruments can be brought to the plant and installed correctly at little expense. Where piping, valves and wiring have not been planned with this idea in mind, accurate results are often impossible unless major changes are made. Turbine manufacturers regularly cooperate with plant staffs not only in planning and supervising test runs and interpreting results, but in helping build test facilities in the original design.

An accurate test is made up of precise measurements of each of the quantities that affect steam rate. While only a brief discussion of each is possible here, a review of good modern testing practice will aid both in planning a test and designing a new installation so that it can be tested conveniently. Specific instructions can be found in the *ASME Test Code for Steam Turbines* and its companion *Information on Instruments and Apparatus*, to which specific paragraph references will be made.

Inlet steam pressure is best measured with a dead-weight or piston gage, Fig. 1. This is also useful in measuring pressure drop through pipe and fittings, as it is accurate within 0.1–0.2 psi. One or more dead-weight gages should be part of every power-plant equipment, for checking dial gages in place. Dead-weight gages are now made commercially. The gage shown in Fig. 1 is good for pressures up to 2400 psi.

Pressure Measurements

During test runs the usual Bourdon gage is satisfactory if it has been calibrated by a dead-weight tester. However, with any gage, the water leg should be measured and allowed for, and the connecting pressure pipe should be tight. The pressure tap should be located in a straight run immediately ahead of the steam strainer and throttle valve. It should have at least two, and preferably four, pipe diameters of straight pipe before and at least one after it. The tap entering the pipe wall should be flush with the inner surface and free from burrs. *Information on Instruments and Apparatus*, Part 2, Chapters 1–6 and the Turbine Code, Par. 203–204, discuss in detail pressure measurements and instruments.

Inlet steam temperatures up to 700 F can be measured satisfactorily by a high-grade calibrated mercury-in-glass thermometer. For the type of thermometer well and other precautions, see Instruments and Apparatus, Part 3, Chapters 1–6, as well as the Turbine Code, Par. 235–243.

As one of the main sources of error in the use of thermometers is heating or cooling of the exposed stem, the thermometer should be well removed from undue heating or cooling influences. The steam temperature should be read and corrected for. Calibrated thermometers can be obtained from manufacturers or the turbine supplier.

For temperatures above 700 F, calibrated thermocouples in specially designed wells, used with a precision potentiometer and a good galvanometer, are necessary. These and other details are referred to in the Turbine Code, Par. 235–243, and also in Instruments and Apparatus, Part 3, Chapter 3. Thermocouples and other necessary equipment can be purchased directly or obtained from the turbine manufacturer. Fig. 2 shows a thermocouple cabinet with a neat and convenient arrangement of potentiometer, galvanometer, standard cell and multiple-throw switch. Thermocouple leads are brought in through holes in the back wall of the cabinet.

Exhaust pressure for condensing turbines should be measured by mercury manometers and a barometer. If no barometer is available, calibrated absolute-pressure gages may be used. For details consult the Turbine Code, Par.

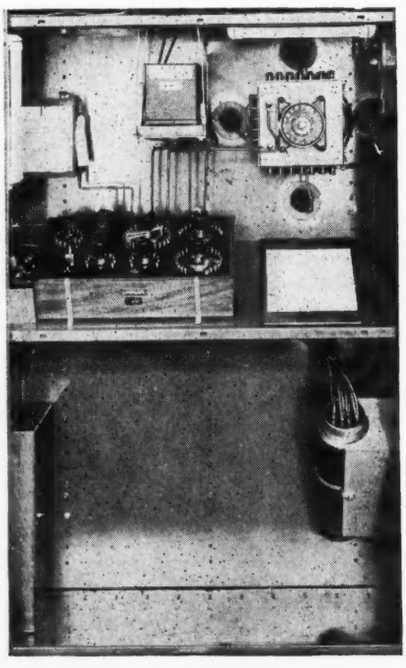


Fig. 2—Portable thermocouple cabinet contains potentiometer, galvanometer, standard cell, switch and ice bottle

228–231. At least two pressure taps are desirable and these should be located preferably in the pipe immediately following the turbine exhaust flange if this pipe is the same size and shape as the turbine exhaust. Otherwise, the taps should be in the turbine casing within a few inches of the exhaust flange. Connecting pressure pipe should be free from leaks and water pockets.

Fig. 3 shows a precision manometer with ½-in. glass tubes. The riders, mounted on a machined post, are held perpendicular to the scale by springs. The lower rider carries the scale so that the upper rider and its vernier give the height of the mercury column directly.

Exhaust pressures above atmosphere should be measured by mercury manometers if within their range, otherwise by dead-weight gages. The pressure pipe should be water filled and free from leaks. Allowance should be made for the water legs. For details, see Par. 218–227 of the Turbine Code.

Electrical Measurements

For electrical output, instrument transformers should be calibrated. This can be done by the maker at small expense at the time of purchase. The secondary burden should equal that of the regular station instruments plus test wattmeters. The latter can be purchased or may be furnished by the turbine manufacturer. They should be read frequently, about once a minute for a one-hour test. If the station instruments are read at the same time as the test wattmeters they can be effectively calibrated in place. Ordinary station voltmeters and ammeters are satisfactory for reading voltage and current and determining power factor. Electrical output measurements are discussed in the Turbine Code, Par. 131–139.

Where weigh tanks with scales or volumetric tanks are available, no additional equipment is required for measuring the steam to condensing turbines. If no tanks have been installed condensed steam can be measured by a flow nozzle, a square-edge orifice or a calibrated water meter in the condensate line. Instruments and Apparatus, Part 5, Chapter 4, should be consulted before laying out the condensate pipe. Minimum straight pipe lengths vary from about 5–25 diameters ahead of and 4–8 diameters after the measuring device, depending on the bends and fittings upstream and downstream of the nozzle.

Since a flow nozzle or orifice requires, for accuracy, a higher differential pressure than can be tolerated in regular operation, the measuring device may be inserted in the condensate line for the test period only, or a separate branch may be provided for it. In the latter arrangement, the bypass should be double valved with a leakoff between to insure against leakage.

Drips, or any other steam or water not chargeable to the turbine, should be diverted from the condenser during test or should be evaluated and deducted from the turbine steam. Air-ejector steam can be determined if the size of the steam nozzles is known and if steam pressure and temperature are measured. Any steam leaving the turbine and not returning to the condenser, such as gland leakage, should be measured and allowed for. Condenser leakage should be measured by one of the methods given in Instruments and Apparatus, Part 21, Chapter 1.

For a non-condensing turbine, the essential flows to and from the turbine should be measured by test flow nozzles or square-edge orifices in the steam lines. For this, it is important to plan the station piping so that necessary lengths of straight pipe before and after the orifice or nozzle position will be provided.

Instruments and Apparatus, Part 5, Chapter 4, gives rules for designing both piping and measuring elements. If the turbine has one or more bleed-offs, it may be convenient to measure exhaust flow with a nozzle or orifice and calculate some one of the extraction flows by difference. Nozzle measurement of steam flow is, of course, possible only where the steam is superheated, as no satisfactory method of determining wet-steam condition is available.

Nozzles or orifices should be small enough to give sufficient pressure drop for accurate readings. They can be installed in place of the regular station flowmeter nozzles or orifices. Differential pressure should be determined by two high-pressure mercury manometers, Fig. 4, or specially calibrated dead-weight gages for extreme high pressures.

For non-bleed turbines exhausting at backpressures above atmospheric and with superheated exhaust steam, the final steam temperature is a valuable check on the internal turbine efficiency. Extreme accuracy of the temperature measurement is required. A calibrated thermocouple should be used, located in a well-lagged pipe run with at least four diameters of straight pipe ahead of it at a point where the steam velocity is 150 fps or less.

For turbine testing, a comparatively short run, say one hour, under steady conditions is preferable to a longer run with fluctuating pressures or load. Exact time of starting and stopping is important if flow is weighed or output read on watthour meters. Time is not so important in reading pressures, temperatures, nozzle flow and wattmeters if conditions are steady. Readings of non-essential data such as turbine valve and stage pressures and various plant meters are useful in interpreting test results.

For uniformity, and to make the test results as clear as possible, the form included in the Turbine Code, Section 6, should be filled in completely. Report should include averages of test readings, calculations, corrections, and explanatory data for each test run.

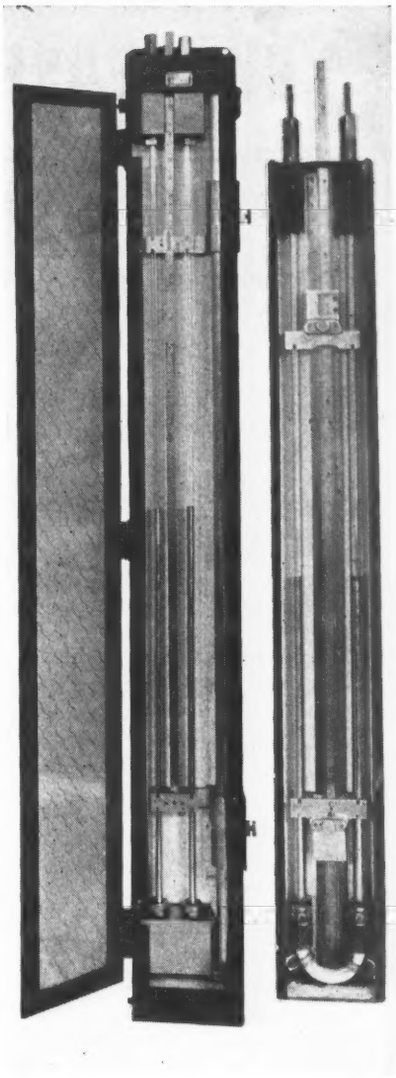


Fig. 3—Precision low-pressure mercury manometer, (right), measures pressure from 15 psi g down to condenser vacuum. Lower rider carries the scale with it so that upper rider reads height of mercury column directly. Fig. 4—High-pressure manometer, (left), measures steam or water flow by pressure differential across calibrated orifice or nozzle temporarily inserted in permanent station piping

NEW LEASE OF LIFE FOR WEARING PARTS

OPERATION	PURPOSE	APPLICATIONS	BASE METALS
Bronze surfacing with (a) Oxweld No 25 M* or (b) No 31 T* bronze rod	To build up worn surfaces with low-melting-point rod, easily applied and machined. For lubricated sliding faces or non-lubricated surfaces with low heat	Pistons, sliding valves, seal rings, reciprocating parts, rocker-arm rollers, lever bearings, gear teeth, shafts, spindles, yokes, pins, clevises	Cast iron, semi-steel, carbon steel, alloy steels, malleable iron, wrought iron, copper-base and nickel-base alloys
Resurfacing with rod of same (or very similar) composition as base metal	To restore part to original condition and size	Badly worn parts rebuilt with rod of same composition preparatory to hard surfacing	All metals ordinarily fusion-welded. Heat-treated alloys that can be rehardened
Resurfacing with Oxweld No 1 high-test steel rod* followed by flame hardening and, if necessary, tempering	To restore part to original size and provide increased wear resistance	Hand shovels, dogs, cams, hand-truck skids, prongs, coal- and ash-handling parts	Metals ordinarily fusion-welded with this rod subject to reasonable wear but not requiring very hard surface
Resurfacing with Oxweld No 32 CMS steel rod followed by flame hardening and, if necessary, tempering	To restore part to original size and provide increased wear resistance. Deposit is harder than Oxweld No 1 high-test rod	Hand shovels, dogs, cams, hand-truck skids, prongs, coal- and ash-handling parts	Metals ordinarily fusion-welded with steel rod requiring harder deposit than Oxweld No 1 high-test rod
Resurfacing with Oxweld No 6 chrome-moly rod, flame hardening and, if necessary, tempering	To restore part to original size with hard and tough surface that can be forged or flame hardened	Crusher rolls, clinker-grinder teeth, dipper-shovel teeth, pulverizers, grinding mills, dies, anvils	Carbon steels, wrought iron, low-alloy steels. Heat-treated steels if care is used to avoid soft spots
Resurfacing or building up, with Oxweld No 9 cast-iron rod, cast-iron parts not subject to shock	To reclaim cast-iron parts subject to wear and return them to service with longer expected life than original item	Cast-iron cams, latches, links, stoker parts, coal- and ash-handling systems	Ordinary gray cast iron. Cannot be applied to malleable-iron parts
Resurfacing with Oxweld No 28 (columbium bearing) 18–8 rod for corrosion resistance and wear	To increase hardness of wearing surfaces with improved corrosion resistance	Wearing parts of processing machinery, chemical and dye equipment, ash-sluice parts	Carbon steels and alloy steels
Hard facing with Hascrome rod (chromium, manganese, iron)	For moderately abrasive wear or severe impact. For base material under wear-resistant non-ferrous alloys	Crusher and pulverizer parts, dipper teeth, mill spindles	Carbon steels, low-alloy steels, alloy and semi-steel castings, gray cast iron (with heat treatment if necessary)
Hard facing with Haynes Stellite "93" rod (iron, chromium, cobalt, molybdenum, vanadium)	For resistance to severe abrasion accompanied by only moderate impact	Dredge-pump impellers, crusher rolls, slag crushers, clinker grinders, tube-bending mandrels	Carbon steels, alloy steels, semi-steel, gray-iron castings
Hard facing with Haynes Stellite non-ferrous wear-resistant alloy rods (cobalt, chromium, tungsten)	For severe abrasion, especially at high temperatures. Hardness and corrosion resistance are retained at red heat	Steam valves and valve seats, engine-valve seats, dies, shearing knives, coal breakers, fan blades	Carbon steels, alloy steels, Monel, semi-steel and gray cast iron. Select from three grades of rod to suit base metal and service conditions
Hard setting and hard facing with diamond substitutes: tungsten-carbide inserts, composite rod or tube rod	For parts subject to extremely severe abrasion	Oil-well drilling tools, dredge cutters, cement-pump screws, grinder rings	Carbon steels, low-alloy steels, semi-steel, gray-iron castings

* *Patented*

BY GAS WELDING

Quick summary of resurfacing processes that restore worn parts to condition as good or better than original. Condensed from specifications by Linde Air Products Co

FINISHED SURFACE	PRETREATMENT	TECHNIQUE	POST TREATMENT
Easily machined to close tolerance. With slightly oxidizing flame, Brinnell hardness at 70 F for rod (a) 96 (b) 105; at 400 F (a) 83 (b) 96; at 500 F (a) 58 (b) 74	Preheating normally not necessary, used only to prevent warping or cracking where a large surface is to be rebuilt	Brazo flux, plentifully applied. Base metal heated only to point at which rod flows over surface like water	Normally none required. Slow cooling desirable, especially with large cast-iron parts
Can be machined as easily as base metal. Flame adjustment as for base metal. Hardness same as base metal	Usually unnecessary. May be advisable if building up large surface area	Follow technique used for fusion welding. Do not overheat	Same as for fusion welding base metal concerned
Can be machined, ground or forged before heat treatment. Brinnell, neutral flame 140, water quenched 260; excess acetylene (2X) 140, †Q350; excess acetylene (3X)200, Q540	Usually unnecessary. If any, same as for fusion welding	The more excess acetylene, within limits, the harder the deposit. Do not overheat	Heat to bright red and quench in water. Reheat to straw (some items) and quench for toughness with some loss of hardness
Can be machined, ground or forged before heat treatment. Brinnell, neutral flame 160, water quenched 410; excess acetylene (2X) 190, quenched 470; excess acetylene (3X) 200, Q550	Usually unnecessary. If any, same as for fusion welding	The more excess acetylene, within limits, the harder the deposit. Do not overheat	Heat to bright red and quench in water. Reheat to straw (some items) and quench for toughness with some loss of hardness
Harder and tougher than deposits of Oxweld No 1. Can be ground or forged before heat treatment. Brinnell, neutral flame 230, water quenched 470; excess acetylene (2X) 280, Q490: excess acetylene (3X) 310, Q600	Usually unnecessary. If any, same as for fusion welding	Same as for fusion welding. Excess acetylene, within limits, gives harder deposit. Do not overheat	Heat to bright red and quench in water. Some items should be reheated to straw and quenched to toughen
Can be ground and possibly machined before quenching. Brinnell, neutral or excess acetylene flame 210; water quenched 440–480	Same considerations as for fusion welding. Preheating should be done only when necessary	Same as for fusion welding using minimum heat. Work out any bright spot, caused by sand, etc	Heat to bright red and quench in water. Do not quench very rapidly nor treat large areas
High corrosion resistance (lowered slightly with increase in carbon). Brinnell, neutral flame, 120, water quenched 165–300**; excess acetylene (2X), 145, quenched 190–340**; excess acetylene (3X) 160, Q260–360**	Same as for fusion welding	For maximum corrosion resistance use neutral flame. Same technique as for fusion welding	Heat to bright red and quench in water. Hardness increased by peening before quenching
Can be ground to close tolerance, forged or heat treated if necessary. Use a slightly excess acetylene flame. Brinnell as welded 250, peened but not water quenched 550	Unnecessary for carbon steels unless large area is to be covered. Preheat advisable for castings and essential on alloy steels	Heat base metal to "sweating" temperature so rod flows over heated area. Don't mix rod and base metal in puddle	When necessary, quench in oil. Annealing advisable for castings and certain alloy steels
Can be ground to close tolerance and heat treated if desired. Use excess acetylene flame (2X). Rockwell C hardness, as deposited, 62	Preheat, as for ordinary welding, helps prevent cracks in deposit	Flux unnecessary but may help for cast iron. Clean base metal well and proceed as above	Can be hardened by heating to 1950 F and cooling in air
Can be finished by grinding to close tolerance. No forging. Unaffected by heat treatment. Rockwell C hardness, as deposited, 40–54	Ordinarily unnecessary for carbon steels up to 0.6% carbon, or Monel. Preheat castings and high-chromium steels	Same as above	When necessary, quench in oil. Annealing advisable for castings and certain high-chromium steels
Surface used as applied. Can be ground. Slightly excess acetylene flame. Insert should be ⅓ submerged in base metal and completely covered with bonding agent	Usually advisable because most base metals have been hardened	No flux necessary or advisable. Do not overheat. For tube or composite rod, bring base metal to sweating heat	Usually none. Annealing sometimes applied to remove possible base-metal stresses

*** Obtained by peening*
†Q—quenched

New Designs Extend Reciprocating-Pump Applications

D F Schaub, Worthington Pump & Machinery Corp, gives pressure and capacity ranges for which reciprocating, rotary and centrifugal pumps are suited and tells how variable-stroke designs have increased applications of reciprocating units

▶ RECIPROCATING PUMPS still have a place in pump applications, a fact frequently lost sight of because of the development of other designs. Not so long ago practically all pumping was done by reciprocating units, but as these were superseded by other designs in many applications, the false impression that reciprocating units have become obsolete was accepted by many engineers. This article shows that they still occupy an important place in the pumping field.

Fig. 2 shows the fields for reciprocating, rotary and centrifugal pumps, based on capacity and pressure. For simplicity, minimum values for both pressure and capacity have been set at 10. However, it should not be construed that pump designs are limited to these values.

Centrifugal pumps cover the capacity range from 10 to 250,000 gpm, a large percentage of which is at 100 psi or less. This does not mean that centrifugal pumps cannot be designed for high pressures, for they are used for values as high as 3000 psi. However, these pumps are generally for capacities ranging from about 100 to 1000 gpm.

Reciprocating pumps cover a capacity range from 10 to 1000 gpm and pressures up to 10,000 psi, but the higher pressures are usually for small capacities; as capacity increases pressure rating decreases.

It can be said therefore that when the ratio of pressure to capacity is very large the reciprocating pump is a natural selection, and when the ratio is small the selection would be a centrifugal unit. No definite line can be drawn between the fields of the different types, because in many instances their ranges overlap.

The uses for the different pumps are brought out more clearly when viscosity is considered. The rotary pump, a medium-pressure, medium-capacity machine overlapping the reciprocating and centrifugal units, comes into its own when viscosity is a determining factor, Fig. 1. Rotary pumps have been used successfully for viscosities ranging as high as 500,000 SSU. This is because their rotors operate at fairly low pitch-line velocities, permitting the liquid to flow into the spaces between the gear teeth. Passages in these pumps are short, of comparatively large area, and do not contain obstructions to flow, such as valves.

Centrifugal pumps are limited to viscosities of less than 2500 SSU. When the viscosity exceeds this, efficiency and capacity drop rapidly.

Viscosity as a limiting factor in the application of reciprocating pumps does not depend on the design, but on the cost of the unit. A reciprocating pump can be designed for viscosities as high as those for rotary units, but such a unit would be prohibitive in cost when compared to a rotary unit for similar conditions.

Modern power-driven reciprocating pumps are highly efficient machines capable of giving many years of dependable service at a low investment outlay, compared to the old slow-speed designs which had all their moving parts such

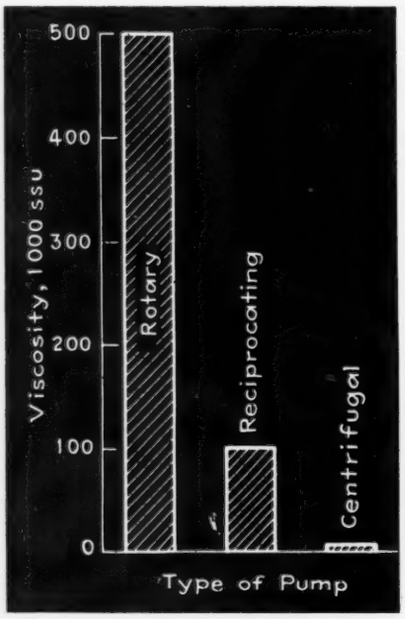


Fig. 1—Viscosity affects rotary-, reciprocating- and centrifugal-pump selection

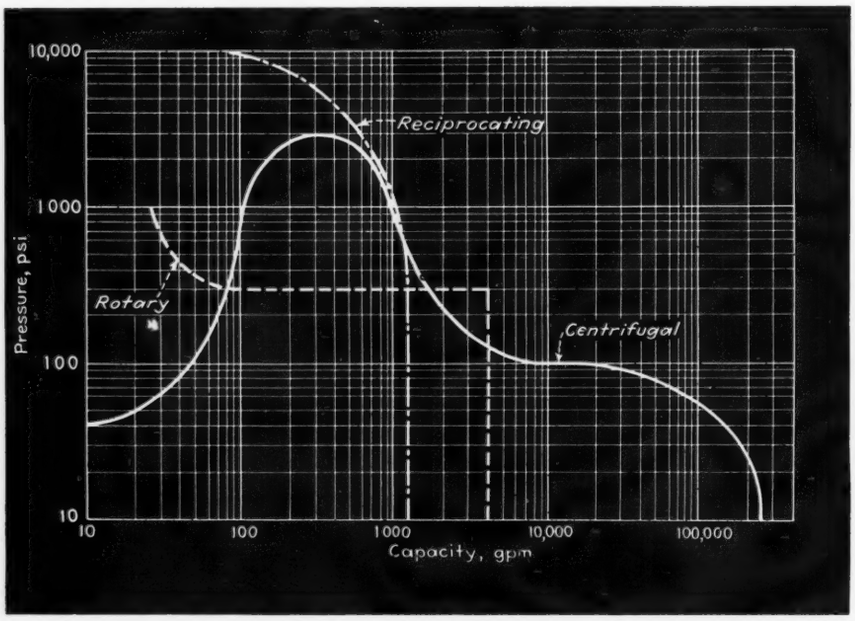


Fig. 2—Approximate ranges for application of reciprocating, rotary and centrifugal pumps; these may be extended if necessary below the minimum of ten shown

as gears, crankshaft and bearings exposed to the atmosphere. Bearings and sliding contacts were lubricated by oil cups or grease fittings and the gears by swabbing grease on the teeth. Modern pumps have all of their running gear inclosed in an oil- and dust-tight power end, Figs. 3, 4 and 5. In this design all moving parts are automatically lubricated by either a small rotary pump supplying oil directly to bearings, or by an oil-splash system in which the main gear distributes oil to all bearings on the power end. This insures proper and adequate lubrication that reduces maintenance cost.

This improvement in power-end design has made it possible to increase crankshaft speeds from 80–100 rpm to 250 rpm, now considered normal. Fig. 5 shows a 4-in.-stroke, vertical-triplex single-action pump rated 25 hp at 250 rpm, used for high-pressure hydraulic services up to 10,000 psi. These pumps perform so successfully that speeds up to 500 rpm are contemplated in the near future.

As crankshaft speed increases, fluid velocities in cylinder passages and through suction and discharge valves also increase, causing higher frictional losses. Head losses also increase, in direct proportion to pump speed, caused by increased fluid acceleration. These losses become serious, particularly at the suction end of the pump at high speeds, but can be considerably reduced by changes in valve design.

Formerly, reciprocating pumps were heavy and costly when compared with other types of the same rating, but higher speed helped to correct this.

Connecting a reciprocating pump to its driver has always been a problem to the designer. The average pumping unit consists of a built-in single-reduction gear having an approximate ratio of 5:1, and a secondary speed reducer mounted between the driver and the pump pinion shaft. The secondary speed reducer is generally a second set of gears built as a separate unit, or a chain or belt drive. Any of these arrangements makes a cumbersome and expensive unit.

With horizontal-duplex pumps, floor space can be saved by mounting the motor on top of the power end and connecting the driver to the pump through a suitable chain drive. This arrangement is used where pumps operate at conventional speeds. Fig. 3 shows a typical refinery installation consisting of three 12-in.-stroke duplex pumps driven by top-mounted motors, through silent-chain drives. With pumps operating at speeds around 250 rpm it is possible to connect a standard-speed squirrel-cage motor directly to the pump pinion shaft with a flexible coupling.

As previously mentioned, reciprocating pumps are suitable for low capacities and high heads. Occasionally, a pump is also required to deliver a variable capacity. A centrifugal pump has a decided advantage over the reciprocating for such service because its output can be varied by throttling the discharge. With a power-driven reciprocating pump its output can be varied only by changing its speed or stroke.

When direct-current motors are used it is a simple matter to adjust the speed by field-current control. However, the majority of pump motors are alternating-current units. A variable-speed ac motor is an expensive machine, with low efficiency at low speeds. Variable-speed transmissions are generally not satisfactory; therefore, it becomes desirable to control the capacity of these pumps independent of their driver. This can be accomplished efficiently and economically by a variable-stroke pump such as Fig. 5. In this pump the crankshaft operates at a constant speed, but by mechanical linkages the stroke is varied to give from 100% to zero output. The stroke can be varied either by manual or automatic control and variable output is secured without sacrificing over-all efficiency and without the use of an expensive drive.

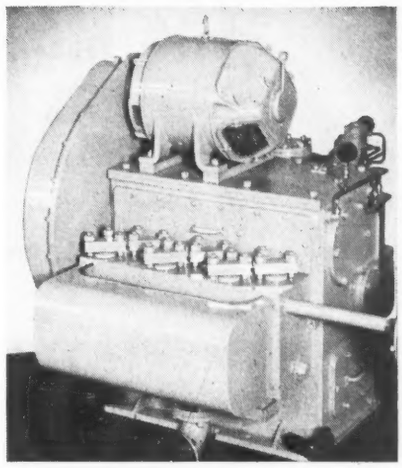


Fig. 5—Totally enclosed variable-stroke triplex pump with top-mounted motor, output of which can be varied manually or automatically from 100% to zero.

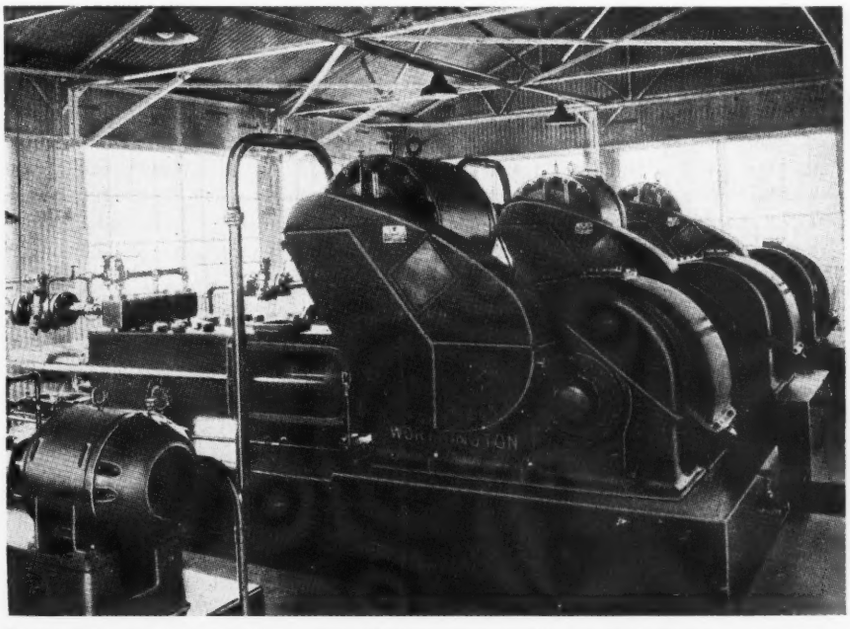


Fig. 3—Three 12-in.-stroke horizontal duplex pumps applied to high-pressure oil-refinery service, driven by top-mounted motors through enclosed silent-chain drives

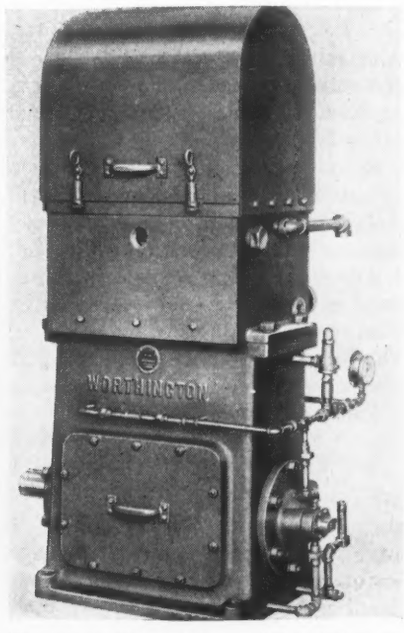
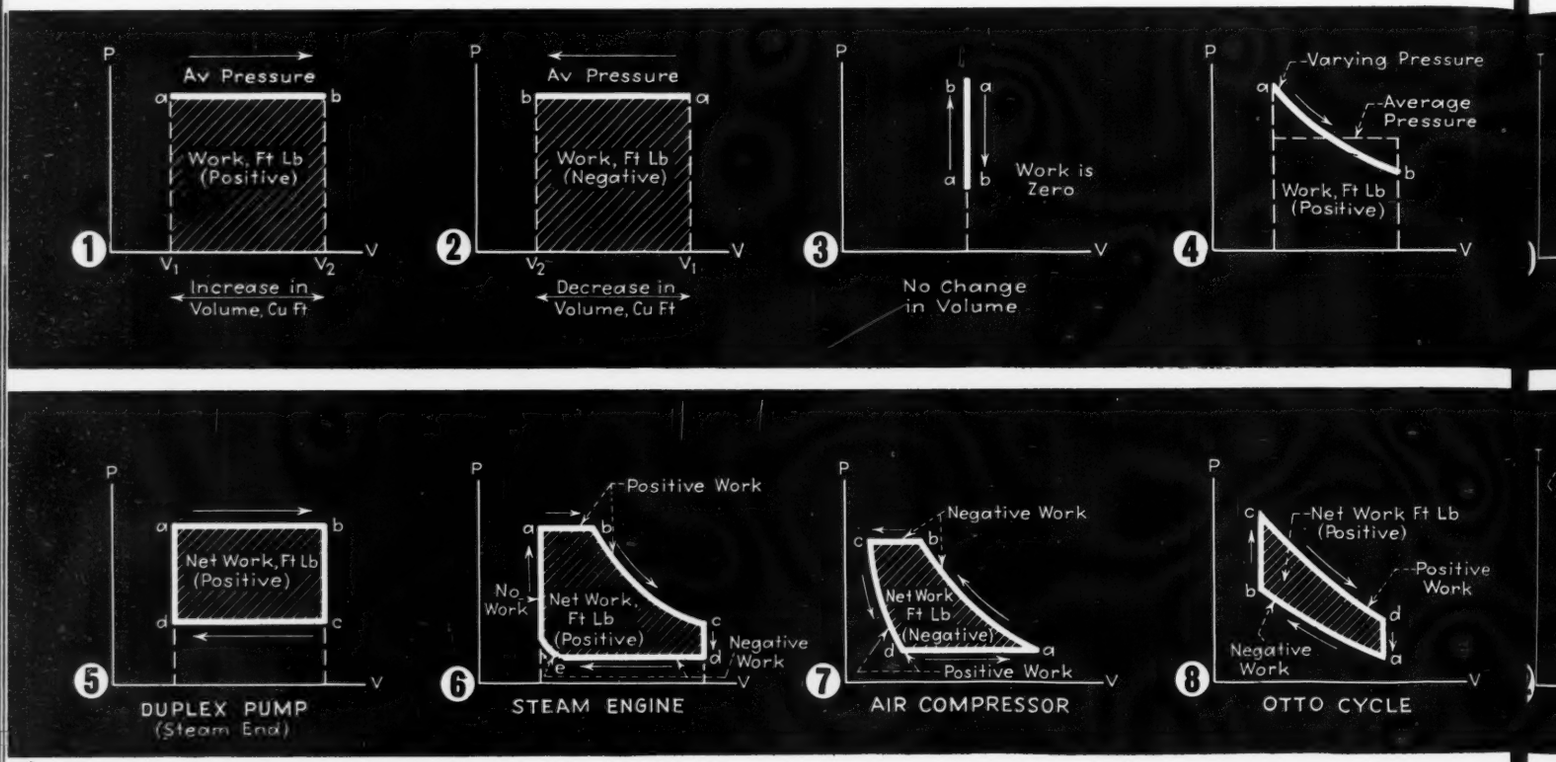


Fig. 4—A 4-in.-stroke vertical triplex enclosed pump with extended shaft

The Meaning and Use of Entropy

On a PV diagram area represents mechanical work. On a temperature-entropy diagram area represents heat received or rejected. Professor E S Gray, ME Dept University of Missouri, shows how diagrams on the "heat plane" help engineers understand power-cycle efficiency



▶ NOW AND THEN IT IS HELPFUL to review the fundamentals of heat power. Although entropy, temperature-entropy and enthalpy diagrams have long been used for practical assistance and visual aid in heat-power operations, engineers still find these matters somewhat confusing. The difficulty simmers down to lack of clear understanding of entropy and the temperature-entropy diagram.

Although entropy is a somewhat artificial property of a fluid it need not be hard to understand as a practical tool. The best starting point is the familiar pressure-volume chart as typified by the ordinary indicator card.

Examples of Work Diagrams

Work done on or by a fluid in an engine or compressor is the product of average absolute pressure by the change in volume of the working fluid:

(1) Work = Average abs pressure $\times (V_2 - V_1)$

If work is expressed in footpounds and volume in cubic feet, the pressure in this formula must be expressed in pounds *per square foot*, 144 times the pressure in pounds per square inch.

Pressure Action

In Fig. 1 a fluid having an average or constant pressure of P lb per sq ft abs acts on a piston while the volume within the cylinder increases from V_1 to V_2 cu ft. The shaded rectangle under the line *ab* is the work in footpounds done on the piston *by* the fluid. Note that this area is the product of the base and altitude of the rectangle. In this case the work is *positive* (that is, the *fluid* delivers work to the *piston*) because V_2 is greater than V_1.

In Fig. 2 the process is reversed; the final volume V_2 is *less* than the initial V_1. Here the work is *negative* because the *piston* delivers work to the *fluid*.

In Fig. 3 the piston is stationary while the pressure increases from *a* to *b* (by heating, for example). In this case no work is done, because there is no change of volume and therefore no area beneath the diagram.

Often pressure varies with volume along a path similar to that shown in Fig. 4. The area beneath the PV curve is still the work involved, and again can be considered as the product of the average pressure and the volume change. This work is positive for increasing volume and negative for decreasing volume.

In Fig. 5 to 8 several simple point-to-point changes are combined to produce cyclic work areas similar to indicator cards of the steam pump, steam engine, compressor and ordinary gas engine, respectively. In each case the net work delivered or absorbed in a complete cycle is the difference between the net positive and net negative areas under the various lines.

Thus in Fig. 5, area under *ab*, down to the zero line, is positive work done by steam on the piston during the work-

ing stroke. The smaller area under *cd* is the negative work done by the piston on the steam during the exhaust stroke *cd*. The difference (shaded area) is the net work and is positive.

These pressure-volume diagrams are work-plane diagrams and don't tell much about the cycle efficiency. In no case do they show how much heat was received or rejected in going from one point to another. Efficiency, in the usual heat-power sense, is concerned with the heat received and rejected by the machine and the difference between the two. Here is the formula: (2) Efficiency = (heat received — Heat rejected) ÷ Heat received = Work done, expressed in Btu ÷ Heat received.

The enclosed area of any complete cycle on the PV plane represents the work done in footpounds. This can be converted to Btu by dividing by 778 for use in equation (2), but the "heat received," still required to determine efficiency from equation (2), remains unknown.

Constructing a "Heat" Diagram

However, if a diagram can be evolved such that the area beneath a line represents heat received or rejected, the total area (in the case of an engine) will represent heat received, while the enclosed area will represent the difference between heat received and heat rejected. Then the efficiency will be the enclosed area divided by the total area.

Temperature (on the absolute scale) and efficiency are closely related. It is a general law, first observed by Carnot, that the higher the temperature at which heat is received by an engine, and the greater the temperature range that the fluid undergoes in its cycle, the greater will be the efficiency of the cycle. This observation preceded the conception of the Carnot cycle itself.

Suppose we let absolute temperature be the vertical measurement or *ordinate* on a plane hereafter called the *heat plane*, in accordance with the above association of temperature and efficiency. If the area of a simple rectangle in the heat plane is to be heat Q, and if the altitude is, by choice, absolute temperature, T, the base of the rectangle must be a factor which multiplied by T equals Q. This factor is a ratio and can only be Q/T. In other words

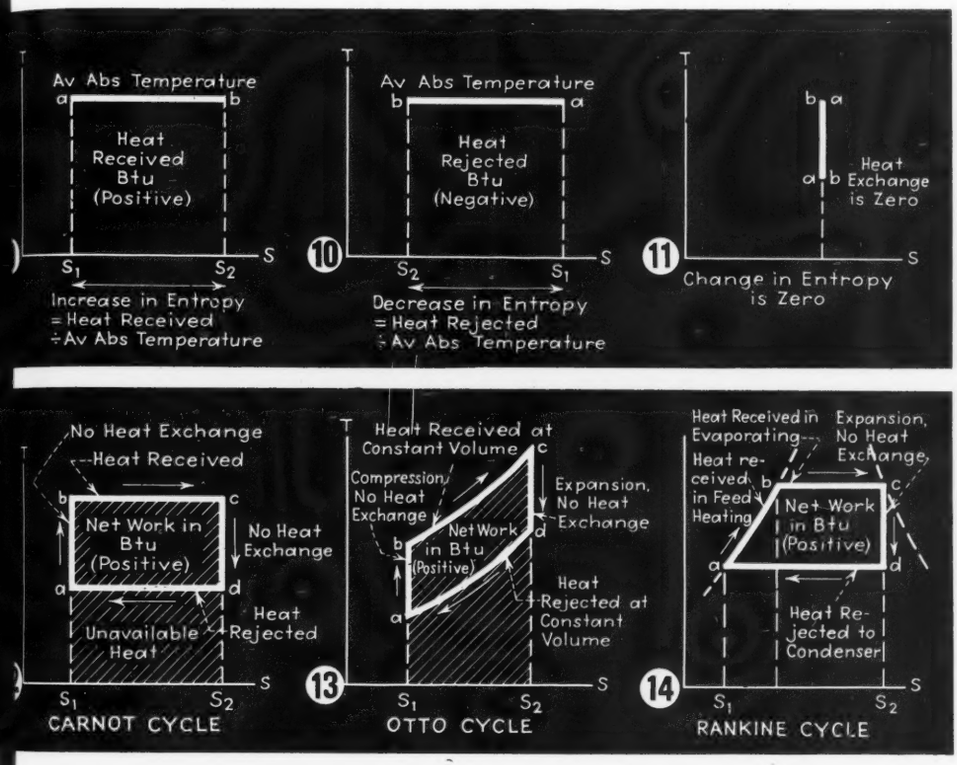
$$(3) \qquad T \times Q/T = Q$$

If the heat added is infinitesimally small, Q can be signified by dQ, and the ratio becomes dQ/T. That is,

$$T \times dQ/T = dQ$$

The ratio Q/T or dQ/T is known as the change in entropy. Entropy is expressed in Btu per degree F. The usual symbol is S, so a change of entropy may be expressed as $S_2 - S_1$, the difference between the initial and the final entropy.

In all illustrations to come we are not concerned with the absolute value of entropy, but with the *difference* between two values. There is in fact no absolute value of entropy, so the steam tables use an arbitrary "sea level" or datum point. They specify *zero entropy* for saturated water at 32 F. It is important to remember that only differences of entropy are of interest.



1—8

Fig. 1 to 8—On the pressure-volume plane the area under a line represents work delivered or received by the piston. The area *enclosed* by a complete cycle represents net work delivered by the engine or consumed by the pump or compressor

9—11

Fig. 9, 10, 11—Compare with Fig. 1, 2 and 3, respectively. Vertical scale is absolute temperature T, temperature F plus 460. The horizontal scale for entropy, S, is such that the area under a line will equal heat absorbed or rejected

12—14

Fig. 12, 13, 14—Various theoretical engine cycles plotted on the temperature-entropy plane. In each case area enclosed in heavy lines is *net* heat utilized and is Btu equivalent of work done

Fig. 9 illustrates a simple situation. Here heat is added to a fluid at a constant or average absolute temperature, T, while the entropy increases from S_1 to S_2. The *increase* or *positive* change in entropy in Fig. 9 indicates that heat is received by the fluid, or is *positive* since temperature must always be positive on the absolute scale. Note the exact parallel to Fig. 1. In each case the area is equal to the base times the altitude and in each the area is positive because the base change is positive. In Fig. 1, the area is work; in Fig. 9 it is heat. Here: (4) Heat received = Av. temperature, F abs. × $(S_2 - S_1)$.

Fig. 10 parallels Fig. 2. Here the change in entropy is *negative* and heat is being rejected from the working fluid, so the heat change is negative.

When, as in Fig. 11, a change in temperature takes place without adding or rejecting heat, the line must be vertical so that it will have no area below. Such a change at constant en-

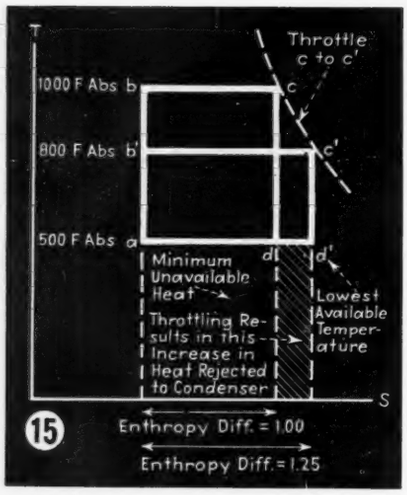


Fig. 15—Theoretical steam-engine operation on Carnot cycle *abcd* shows efficiency of 50% (500 ÷ 1000). If steam is throttled to 800 F abs before entering the engine, the efficiency will be thereby reduced to 37.5% (300 ÷ 800)

tropy is known as a *reversible adiabatic* or an *isodynamic* process. An example is the compression of air in a perfectly insulated cylinder. The temperature of the air rises although no heat is added. The entropy does not change.

Such a process is reversible in the ideal sense that if the history of the change is repeated in the exact reverse order the fluid will return to its original situation in all respects.

A reversible adiabatic compression with rising temperatures takes place in the ideal cycle of an internal-combustion engine. A reversible adiabatic expansion, with falling temperature, takes place in the power-stroke expansion of gas in the same engine or in the ideal steam engine or turbine nozzle.

Engine Cycles

Fig. 12 combines point-to-point changes in the heat plane to include the Carnot cycle, the most efficient possible heat-power cycle working between any two indicated absolute temperatures. Note that the increase in entropy from point *b* to *c* is equal to the decrease from point *d* to *a*. Heat received along *bc is area* bcS_2S_1. Heat rejected along *da* is area daS_1S_2. The difference (enclosed area *abcd*) represents net heat utilization and also the net work of cycle in Btu. This, divided by heat received, bcS_2S_1, gives the efficiency of the Carnot cycle.

Since the efficiency of the Carnot cycle is the ratio of the area *abcd* to the area bcS_2S_1, it is also the ratio of *ab* to S_1b. From this it will be seen that:

(5) Efficiency of Carnet cycle $= \dfrac{T_1 - T_2}{T_1}$

= Temperature drop ÷ initial absolute temperature.

In the formula T_1 is absolute temperature at which heat is received and T_2 is absolute temperature at which unused heat is rejected.

Fig. 13 illustrates the Otto cycle for spark-ignition gas engines. Here efficiency equals area *abcd* divided by area bcS_1S_2.

In Fig. 14, representing the Rankine (steam turbine) cycle, the efficiency is again the enclosed area divided by the total area, or area *abcd* divided by the area $abcS_1S_2$.

Why Throttling is Wasteful

It is well known that *wire drawing* or throttling is a wasteful thermodynamic process in any steam heat-power operation. That throttling reduces the availability of heat energy for conversion to mechanical energy can be proved with the aid of the Carnot cycle.

First note that all cycles have limitations as to their efficiency. No fluid in a closed continuous repeating cycle can be expanded to a temperature lower than the surroundings (as T_2 in Equation (5) and Fig. 12 and 14). Thus steam cannot be expanded to a temperature lower than the cooling water and heat in the exhaust steam must be delivered to the cooling water at this temperature.

It will be assumed in Fig. 15 that a Carnot steam cycle, *abcd* is first working between the temperature limits of 1000 F abs (T_1) and 500 F abs. (T_2), these being the maximum and minimum temperatures then available. The initial efficiency will be 50%, because (1000 − 500) ÷ 1000 = 0.50.

Expressing it another way, one could say that the availability of the heat supplied under these conditions is 50%, as far as conversion to work is concerned. If the heat chargeable to the cycle is 1000 Btu, that converted to work is 500 Btu (area *abcd*) and that rejected is 500 Btu (area under *da*). The maximum change in entropy, *ad*, is 1000 Btu ÷ 1000 deg = 1.

If the initial steam is throttled from c to c′, the pressure drops without doing work. No energy is "lost" in throttling, but its availability for power generation is reduced.

Let's assume that the throttling reduces the temperature say to 800 F abs. Total area under b′c′ (down to zero line) must equal total area under *bc*, since heat chargeable is 1000 Btu in both cases. T_2 remains 500 F abs as before. The new Carnot cycle is *ab′c′d′* and its efficiency is (800 − 500) ÷ 800 = 37.5%. Here heat converted to useful work is 375 Btu (enclosed area *ab′c′d′*) while 625 Btu (area under *d′a*) is rejected. Dividing total area of 1000 Btu by new height of 800 F, we get an entropy change of 1000 ÷ 800 = 1.25.

Note that the entropy spread is 0.25 units greater than before. The loss caused by throttling is graphically represented by the area under *dd′* as 125 Btu, and is equal to the growth of entropy, 0.25, times the lowest available temperature, 500 F abs.

Thus throttling losses become apparent only when viewed on the heat plane by an analysis of the heat exhausted. The efficiency of the Carnot cycle in this case measures the availability of the heat received for conversion into useful work.

Fig. 15 also demonstrates the effect of "irreversibility" on heat-power efficiency. In the flow of heat under steady conditions the temperature falls in overcoming thermal resistance such as heat flow through boiler plate. The first condition (T_1 = 1000 F abs) of the cycle might represent the temperature of the heat energy before passing the barrier. The second condition (T_1 = 800 abs) follows after the flow of 1000 Btu has dropped the temperature to 800 F abs. This variety of heat flow is an irreversible process, as heat cannot flow back to the higher temperature. The net result is again a growth of entropy and a reduction in the availability of the heat energy supplied.

A non-reversible thermodynamic process may be crudely compared with the scrambling of eggs. Eggs cannot be unscrambled and steam cannot be "unthrottled." On the other hand air adiabatically compressed can be adiabatically "uncompressed."

Compression and Efficiency

The process of compression in an internal-combustion engine, whether spark ignition or otherwise, increases the cyclic efficiency. This can be demonstrated easily by plotting the Otto gas-engine cycle as a temperature-entropy diagram.

From the air-standard point of view, the efficiencies of both Carnot and Otto cycles are fundamentally dependent only on absolute temperature before and after compression. Efficiency can be increased by raising the top temperature or lowering the bottom temperature. While the efficiency of the diesel cycle does not follow exactly the same rule as the Carnot or Otto cycles, it also increases with increased compression ratio. The true diesel has a higher compression ratio than the Otto engine because the diesel compresses air only, so cannot pre-ignite. It it this higher compression that gives the diesel its higher efficiency.

WARTIME POWER CLINIC

Practical ways to create emergency capacity. Cures for overloads, breakdowns, short-handed staffs, lack of spare parts, etc. Contributions invited at regular rates

What Problems Have You Solved?

That the readers of POWER are a mine of practical information is again shown by the wealth of comments on bearings in May and in this number. It all stems back to an editorial note about an operator in Connecticut who wanted to know what to do when he couldn't buy replacements for a worn-out roller bearing on an essential machine. This opened the question of emergency bearings from every angle. Suggestions published include a variety of information on journal bearings—brass, iron, good babbitt, wartime babbitt, even wood—also on homemade roller bearings. Further bits of bearing information will be published in future numbers, but the *emphasis* must now shift to other wartime problems of the power man.

The comments that appear each month in this "Clinic" would not be published to solve the problems of any one reader. They must refer to difficulties that might be encountered by many readers. That is one test of what is worthwhile. If you are thinking of contributing, here are two more tests that material for the Clinic must pass: Is yours a wartime problem? Have you a practical solution?

Right now thousands of engineers want to know how to get more capacity out of existing boilers, pumps, compressors, engines, turbines, generators and motors—how to schedule maintenance and avoid breakdowns, how to make emergency repairs, how to get along without the usual supplies, replacements and materials—how to keep green men from making serious mistakes, how to train new men in a hurry, etc.

Keep 'em brief and practical and don't forget to include a clear sketch or two for POWER's artists to redraw.

PHIL SWAIN

Use Roller Bearings—They're Easy to Make

IN FEBRUARY POWER I read that an engineer in Connecticut had tried to machine a cast-iron sleeve bearing as replacement for a ball bearing, with highly unsatisfactory results. My advice, under such conditions, would be to make a roller bearing. While it is not as simple as a sleeve bearing, a roller bearing is not as difficult to make as one might think. I made one once, on the order of the attached sketch, as replacement for a tapered roller bearing that had been badly chewed up.

Inside and outside tracks were made of cold-rolled steel and case-hardened with potassium cyanide. I had no electric furnace so was compelled to use a blacksmith's forge for heating. I did not apply the cyanide to the metal in the fire, as is the custom with some blacksmiths. Instead, I heated the metal to a bright cherry three times, each time quenching to blackness in a pan of finely pulverized cyanide, leaving the fused cyanide sticking to the metal when replacing it in the fire. Three heats should suffice, I reasoned, as by the time the hardened depth wore off the bearing would need replacement anyway.

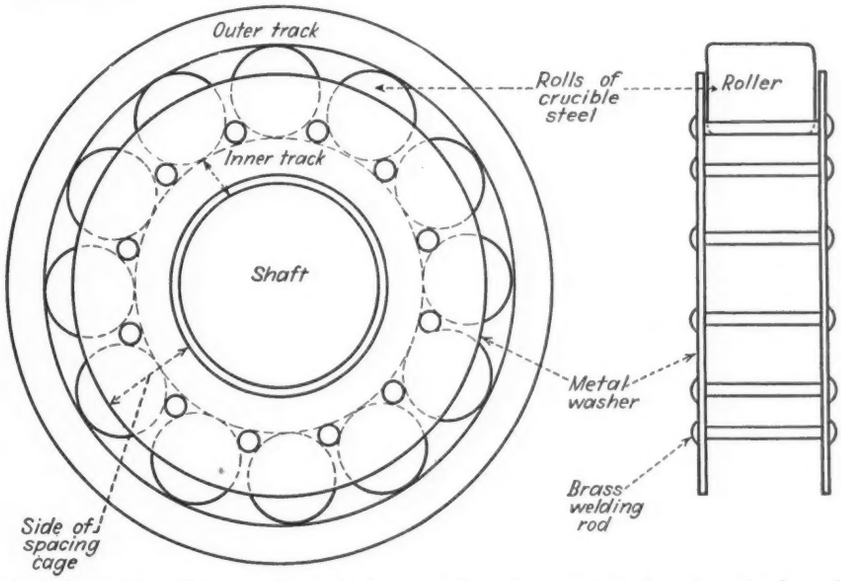
Rollers were made of crucible steel and quenched from full cherry in linseed oil. I had no equipment for grinding the rollers, although I could have ground the two tracks.

I made the spacing cage of two sheet-metal washers pinned together with the inside track between them. I used brass welding rod for spacer pins, although in a pinch nails or heavy wire might serve equally well.

Menard, Ill. GEORGE HOLMAN

How to Use Laminated-Plastic Bearings

SUBSTITUTION OF LAMINATED-PLASTIC bearings on machines previously using babbitt or bronze has accomplished substantial savings in these critical war materials. In many applications the plastic has proven superior to the bearing metals replaced. Extensive research has continually improved the properties



Crucible steel rolls were heated cherry red and quenched in oil. Tracks, of cold-rolled steel, were case hardened with cyanide

of synthetic-bonded bearing materials and opened up wider fields of application.

To solve the problems of replacing bearing metals with laminated plastic it is necessary to know the properties of each material, as well as why and how each is used. "Micarta" laminated-plastic bearings, manufactured by Westinghouse, have been successfully applied in steel mills, rubber-mill line drives, cement mills, deepwell pumps, water-wheel guide bearings, rod mills and on ships. Numerous other applications are being worked out where Micarta will replace tin-base babbitt, bronze, lignum vitae, wood and rubber.

To avoid scoring from metal-to-metal contact, bearing metals are softer than the journals or shafts. Laminated bearing materials are softer than bronze and steel. Several physical properties, such as compressive strength, modulus of elasticity and coefficient of friction, are similar for lead-base alloys and laminated materials. Under certain speed and pressure conditions, *with water as the only lubricant,* the coefficient of friction is much lower with laminated materials than with bearing metals. This lower running friction means less power to operate the machine and in turn results in good wearing qualities of the laminated bearing.

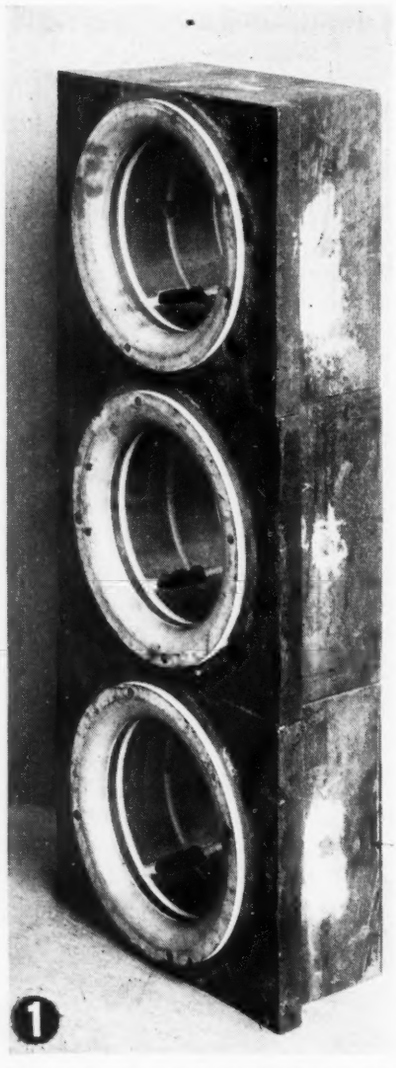


Fig. 1—Laminated plastic (replacing babbitt) for pinion stand bearings

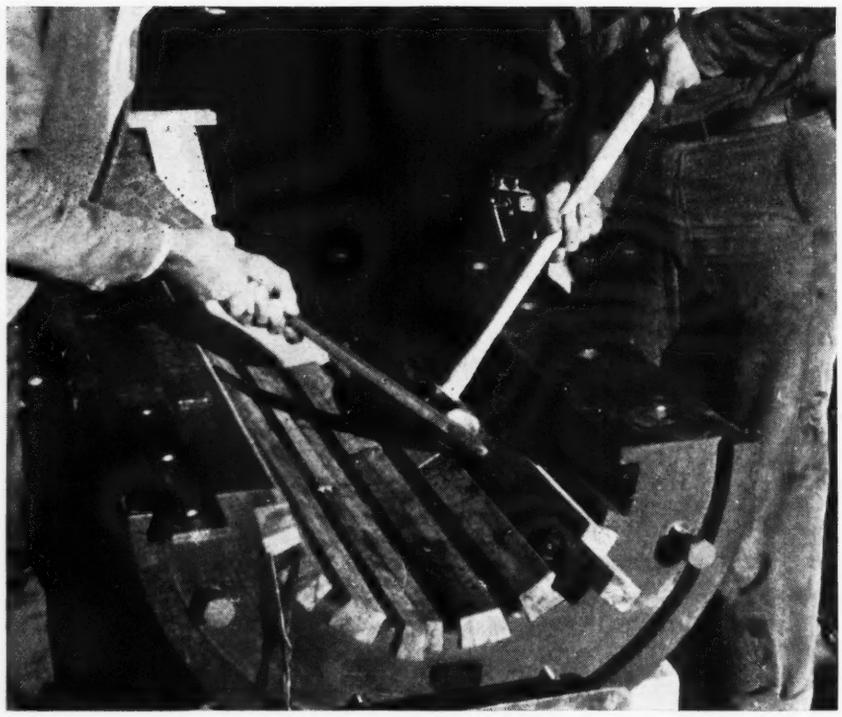


Fig. 2—Here laminated plastic blocks replace lignum vitae in vertical waterwheel guide bearings. Original clearance about 0.009 in. Wore about 0.0025 in 4 years

However, starting friction of laminated bearings is higher than for some metal bearings and therefore must be considered, especially for machines that start and stop often.

The thermal conductivity of tin-base babbitt is about 100 times that of Micarta. Heat flow through the latter is negligible. The use of graphite and mineral-loaded resins in processing the laminated bearing materials has improved their thermal quality, but it will never be the same as the bearing metals. This thermal characteristic is by far the most important thing to consider in applying laminated bearings and must be offset by a more efficient lubricant cooling circuit.

The ideal applications of laminated synthetic resin-bonded bearings involves immersion in enough cool, clean water to prevent the friction heat from raising the temperature to any great extent. This surrounding water must flow freely to the bearing area. Boat bearings, waterwheel guide bearings, pump bearings and agitator-propeller bearings are in this class. Next best arrangement is either water or oil piped to the bearing. Where water is used it should flow over the journal and then be allowed to run off. It is best to spray the lubricant and coolant on the journal to break up the hot film. Oil or water-soluble oils can be circulated.

Trafford, Pa. V E Enz
Trafford Micarta Works
Westinghouse Elec & Mfg Co

Use Wooden Bearings

In the April "War Clinic" you asked what to do in case one cannot get metal for bearing replacement. The answer is "use wood"—rock maple, apple, beech and so on, with no more bearing surface than with babbitt. Such bearings have worked for years in country sawmills where they had to go on main-line countershafts, bench saws, any small high-speed shafting or machine. Don't finish bore too smooth. Smear with grease and powdered graphite. Get that first smooth bearing and then "let 'em go."

Your great-grandad did it—can't you?

Bloomfield, N. J. E A Earle

Improvised Burner Serves Emergency Needs

Necessity is still the mother of invention, and the national emergency will certainly produce many problem children like the one at the University of New Mexico heating plant.

A 30-ft wall of water rushing down a small desert wash would seem to be an

impossibility. It happened, though, ten miles northwest of Albuquerque, New Mexico, on October 10, 1941. The 6-in. main carrying natural gas from the Farmington field 200 miles away was cut like soft wax, and Albuquerque was without gas for four days. This accident caused the first natural gas outage in this center of 60,000 people and prompted the University of New Mexico to plan the installation of auxiliary oil-burning equipment for its two Babcock & Wilcox Stirling boilers.

Standard equipment could not be had, for priority regulations blocked purchase. Very little money was available, anyway; therefore, if the installation was to be made, ingenuity and makeshift equipment would have to do the job. The auxiliary equipment was installed, and the accomplishment represents the methods that will have to be employed with increasing frequency in similar instances during the next few years.

All labor was supplied under the regular heating-plant maintenance program. The 1000-gal oil storage tank and accessories were purchased for $99.03. Valves and fittings costing $21.89 were used, and feed lines were salvaged from pipe stock on hand. Used oil burners were donated by the local utility, and they were refitted by the NYA machine shop on the campus. A Worthington steam-driven pump formerly used for classroom work was revived for use on the feed lines.

Under ordinary conditions, any power-plant man would smile when he saw this job, which is crude by modern standards. Air crews in the Pacific and elsewhere are piecing together serviceable craft which even their makers would hardly recognize, and we at home must also do the best we can with what we have. The days when you could fix your car with wire and a pair of pliers are gone, but a modern version of that feat in the power plant field is exemplified in this case.

Albuquerque, N. M. STEPHEN S KOCH

Separated Boilers Improve Operation

WHEN IT COMES TO GETTING the most out of existing equipment without stoppages or slowdowns, I wonder if some operators have considered separating their steam lines if heavy process steam demands interfere with the steam supply to engines or turbines?

One plant, operating two boilers supplying generating equipment and a heavy fluctuating process load taken off a common steam header, had difficulty handling the electric load because of low steam pressure at times of maximum process-steam demand.

It was thought that one boiler could carry the maximum electric load satisfactorily, so the steam lines were separated by installing a division valve in the common header. The arrangement worked well. Pressure dips caused by process demand had no effect on the generating equipment and were not objectionable in the manufacturing process as they occurred at intervals, with sufficient lapses to permit restoring the pressure. If the electric load was not severe, steam could be bypassed into the process line and manually controlled.

As steam-atomizing oil burners were used, the combustion rate of the process boiler decreased with a drop in pressure. This condition was rectified by piping steam for atomization from the boiler carrying the electric load, which was always at a constant pressure.

Melrose, Mass. E MACDERMOD

Trick Hookup Replaces Centrifugal Switch

RIGHT IN THE MIDDLE of last winter's cold snap trouble developed in the motor on a heating condensate pump. Inspection showed that the centrifugal switch was broken and would not open the starting-winding circuit of the motor.

This switch was impossible to repair. To add to our woes, it had to break on a Saturday afternoon before a holiday, making it impossible to buy a replacement part for at least three days. We tried running the pump continuously, but it soon became steam bound.

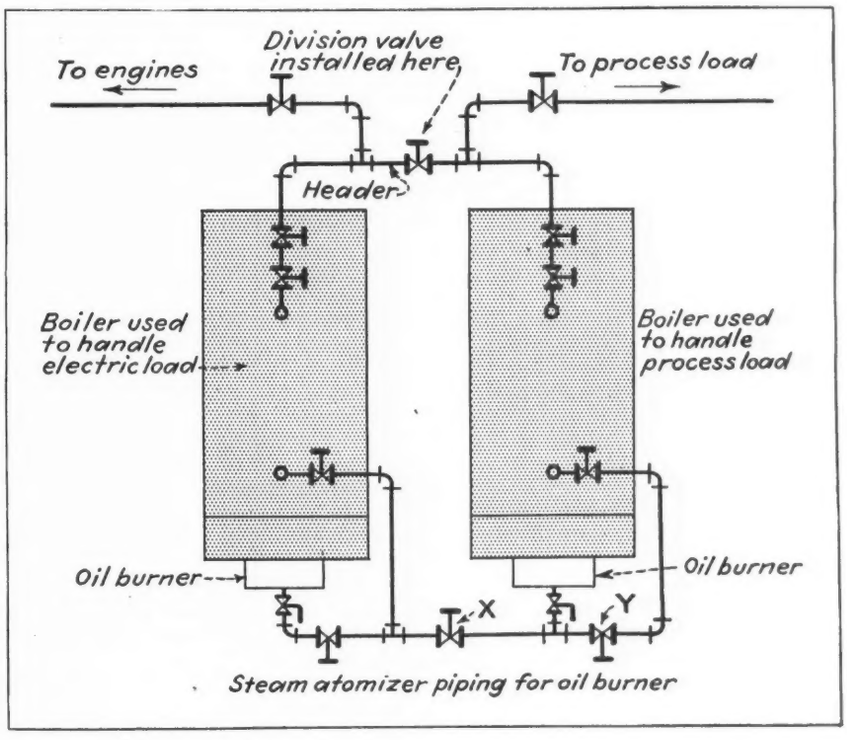
We then removed the end bell from the motor, taped the switch open and brought out two leads from each contact. These leads were connected to a single-pole, single-throw switch.

Since it took about 15 minutes for the condensate tank to fill, we instructed the fireman to come over every quarter hour, close the main switch with one hand and open the single-pole switch one second later with the other.

Since it isn't considered good engineering these days to make a centrifugal switch out of a fireman, our next problem was to devise some means of doing the same job mechanically. What we needed was a switch that would open a circuit about one second after the power was applied.

A trip to the junk box unearthed a power pack from an old radio, a 110-volt bell, a relay from an air conditioner and a helical spring.

Although the relay was designed to operate on 110 volts, we found that it worked just as well on the output of the power pack. The relay was designed to *close* a circuit, so we removed the contacts from the 110-volt bell and put them on the other side of the relay armature so that it would open a circuit.



Opening valve *X* and closing *Y* permits constant combustion regardless of pressure on process boiler

The spring was added to hold the contact shut until power was applied. We then wired the pieces together as shown in the simplified diagram at the bottom of this page.

In operation, when the tank filled, it tripped a mercury float switch, this applied 110 volts ac to the motor and the power pack through a relay. As soon as the filament of the rectifier tube heated up enough to emit electrons (about one second) it would actuate the relay shown in the diagram and open the starting winding on the motor. This time delay could be varied to five seconds by adjusting the spring.

Washington University Power Plant
St. Louis, Mo. ALBERT A SCHULKE

How About Sloppy Consulting?

HERE'S AN ANSWER to "Consultant Attacks Sloppy Operation" in April POWER. I might call this "Operator Attacks Sloppy Consulting." Volumes could be written about consultant-designed plants that are so nearly inoperative as to make the operator's job one steady headache—plants so faulty in design that the operator must use every ounce of skill to keep the plant on the line even part of the time—plants with no reserve capacity or equipment—plants where a consultant has spent too much money on some of his pet ideas and has thus eaten into the appropriations to such an extent that he has to curtail on essentials. However, such criticism is no more constructive than the criticism of the operator by the consultant.

The days of the "checker playing" operator are long since past. With a very few exceptions, the operator of today is modern, intelligent and well-informed on the operation and maintenance of the equipment in his charge. Many of the mistakes made by consultants (and they are made, believe it or not) would never have been made if they had worked with the operator, asking his advice, ideas and thoughts on the proposed equipment.

Many operators in the modern plants of today are perfectly capable of doing their own designing and layout work. Fewer mistakes would be made, and fewer plants would have to be revamped after a short period of operation, if the consulting engineer would make friends with the operator and get an operator's slant on the proposed changes. If consultant, operator, and management would work together, the road for each would be smooth and the result would be a power plant of which all three could be proud.

Rochester, N. Y. H P KING

A Word About Consulting Engineers

WHILE THE ARTICLE "Consultant Attacks Sloppy Operation" (Wartime Power Clinic, POWER, April, pg 85) was right on the beam, it will be painful reading for many and may result in your receiving a flood of recriminations, as operators do not take kindly to criticism from consultants. If you don't receive any complaints, it will be because of that attitude of "it doesn't apply to me" that your anonymous consultant neglected to mention.

Any resentment an operator may have for consultants is not entirely without justification, however, because of the latters' unwillingness to admit the superfluity of some of their own proposals, and their unwillingness to listen to a mere operator's views, which are not always fallacious.

One such instance (it should have had Donald Nelson chewing his fingernails) occurred when a turbine was being installed in a small plant, but one big enough to require the services of a consultant.

For some reason the turbine came with an oil-cooler that seemed as big as the machine itself. Awed by the physical dimensions of the cooler, the operator obtained data from the manufacturer. His computations indicated that if the total generator capacity was dissipated in heat, that oil-cooler was big enough to carry the heat away.

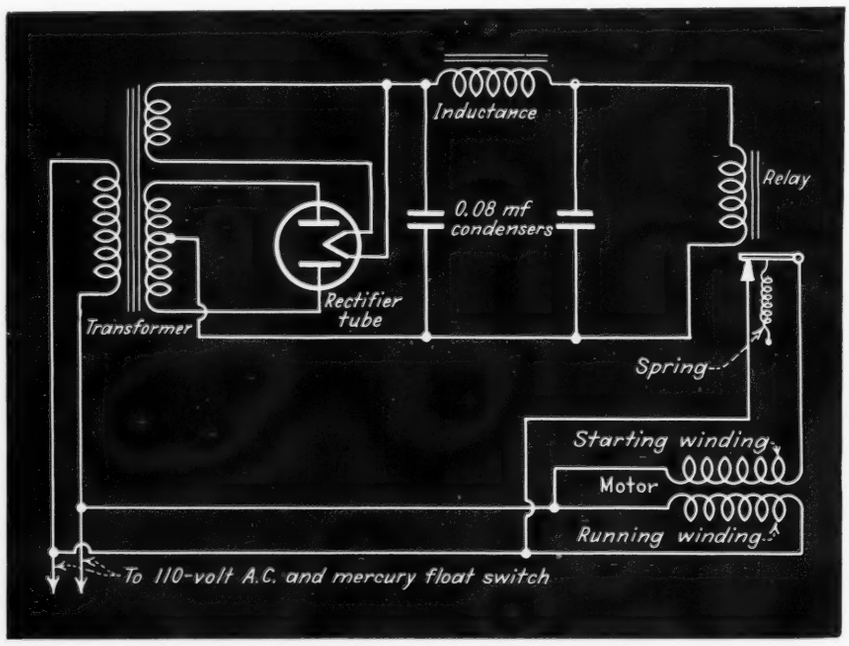
Although this fact was mentioned to the consultant, the operator's comments were received with hauteur and disdain, and several hundred feet of 2-in. extra-heavy galvanized wrought-iron pipe were run full sized to the inlet, and from the outlet, of the cooler. When the turbine was placed in operation, a sufficiently close adjustment of the cooling-water inlet valve could not be made so that the oil would reach a proper temperature for good governor action. If the inlet valve was closed the oil temperature skyrocketed.

The inlet valve was bypassed with a ¾-in. connection. With this bypass valve open but a few turns, the proper oil temperature was maintained. Why did the consultant insist on running 2-in. pipe when ¾-in. would do?

I am sure that the average operator respects the broad experience and ability of the majority of consultants. Why not a little reciprocation, particularly when it is down-to-earth horse-sense? The consultant could also take more interest in the obtaining of proper operators by and for his clients, and use his influence to see that license examinations are in tune with the times.

Massachusetts
(*Name omitted by request*)

(These arguments about the relative virtues of consultants and operators are mighty interesting, but the sole job of this Clinic is to exchange practical ideas for winning the war on the power-plant front, taking human nature as it is. Anything to say on this?—EDITOR)



"Power pack" from old radio provides delayed impulse to operate relay

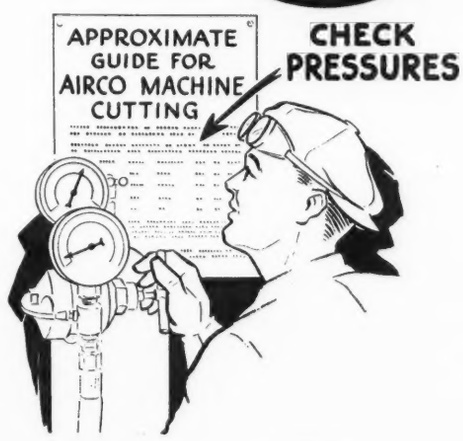
HERE'S HOW TO SAVE OXYGEN

WITH BOOMING WAR PRODUCTION, the demand for welding and cutting gases has increased enormously. This is particularly true of oxygen. As a result, the oxygen-producing capacity of the oxyacetylene industry is being strained to the limit. A critical situation faces this industry, and all industries consuming its products, unless efforts are made by everyone to conserve oxygen.

These "do's and don'ts" are based on facts and suggestions supplied by the Air Reduction Sales Corporation, which is asking your cooperation in an effort to conserve oxygen for shipbuilding and other essential war work by eliminating wastes that average 25%.

POWER readers use substantial quantities of oxygen in various maintenance applications of welding and cutting throughout all industries. They have already faced the need to conserve fuel, steam, electricity, tin, copper and rubber. Now oxygen joins the list of supplies made precious by war demands—and again power men will do their bit by eliminating waste.

Here are suggestions for the boss to read—and then why not post them for the benefit of every man who uses oxyacetylene for cutting or welding? (*Note: As a practical service to readers,* POWER *will furnish a single clipping of this article free to subscribers requesting it while supply lasts.*—EDITOR.)



1 Choose the right tip and keep it clean

An oversized tip wastes gas. For example, if a No. 2 tip is used instead of a No. 1 for cutting ½-in. plate the oxygen waste will be from 10 to 20%. Also, 15% more acetylene will be used.

Use cleaning drills to avoid waste of time and gas by dirty tips. Incidentally, cleaning drills will check tip sizes if number is not clear.

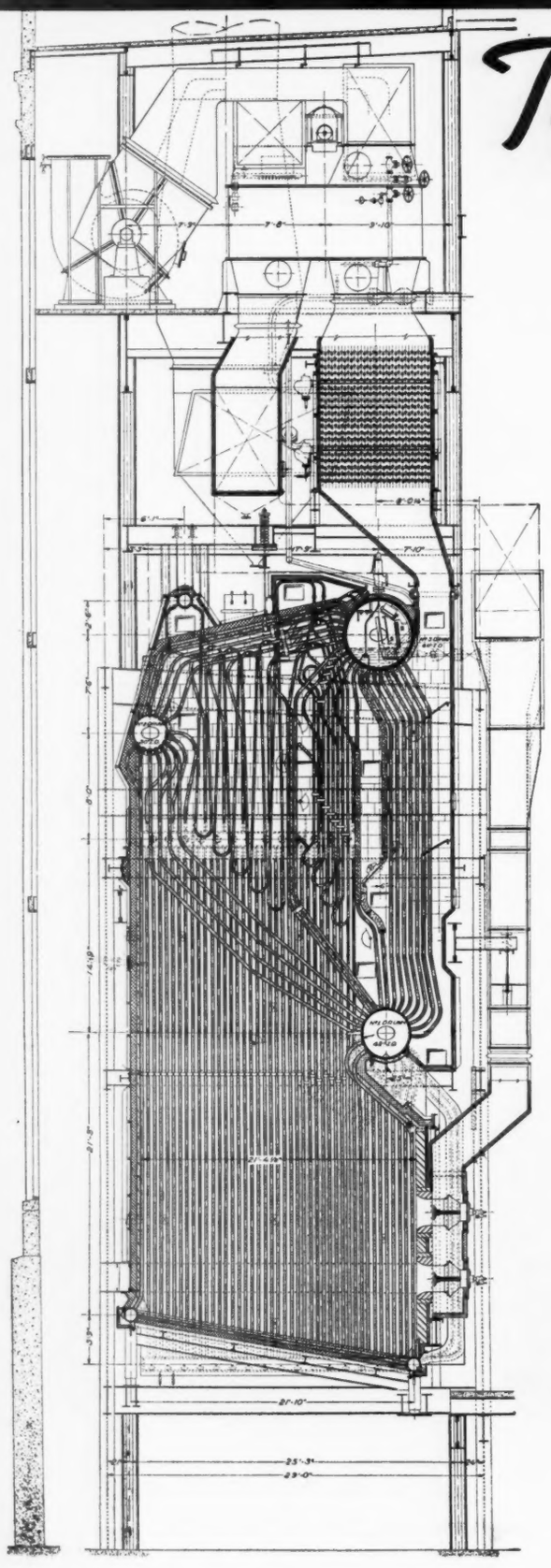
2 Don't use excessive pressures

Inexperienced operators often use too-high pressure, imagining they will thereby get a more efficient flame or save a trip to the pressure chart. Manufacturers' rated pressures are the most efficient for average conditions, and they save oxygen, so keep the chart handy and use it. Where more speed is desired, a new high-speed cutting tip will cut faster without consuming additional oxygen.

3 Close cylinder valve when finished

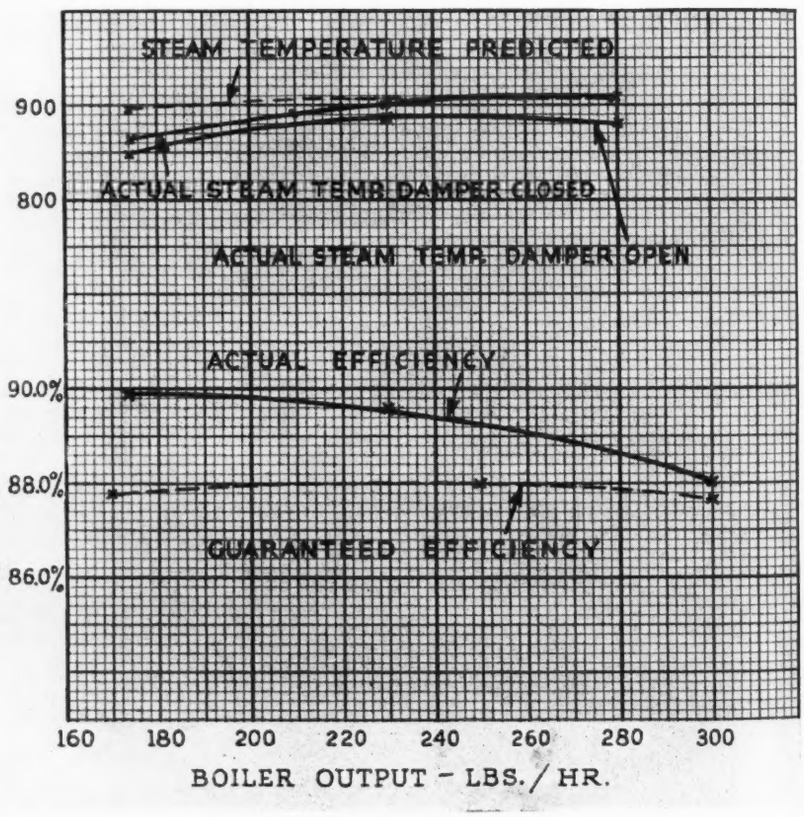
If only the torch valves are closed, gas pressure in the hose rises and may force leaks. These new leaks, or those already present, may waste much gas.

(CONTINUED ON PAGE 98)



Typical Results from

Pounds of Steam/hr.	176,000	231,800	280,100
HEAT BALANCE			
Moisture in Fuel	0.02	0.02	0.02
Hydrogen in Fuel	5.47	5.53	5.54
Moisture in Air	0.10	0.12	0.13
Dry Chimney Gas	2.84	3.37	3.48
CO	0	0	0
Rad. and Unaccounted for	1.77	1.35	2.23
Actual Efficiency	89.8	89.6	88.6
Guaranteed Efficiency	87.8	88.0	87.9



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It will pay you to visit modern Riley Installations

a RILEY Steam Generating Unit

Results from this 300,000 pounds per hour, 1025 pound pressure, 905°F. total steam temperature Riley Steam Generating Unit installed in a large southern public utility company is typical of results being obtained from Riley Units throughout the country. Here again actual performance exceeded guarantees. This excess of actual efficiency over guaranteed efficiency means an additional annual saving of approximately 100,000 gallons of oil. A plus of real dollar value.

Installation after installation of Riley equipment is operating at higher efficiencies than guaranteed. On eighteen recent installations actual efficiency averaged 1.19 points above guarantees. At the same time Riley Units invariably can be operated at higher capacities than guarantees and with complete reliability and a minimum of maintenance, assuring continuity of operation and high availability.

It is because of such outstanding performance that so many of the country's outstanding installations use Riley Steam Generating Units. Within the past year the following well known companies have ordered Riley Steam Generating Units.

Recent RILEY Installations

Commonwealth & Southern Corp.
Gulf Power Co.
Mississippi Power Co.
Southern Indiana Gas & Electric Co.
Republic Steel Corp.
Dow Magnesium Corp.
Carnegie Illinois Steel Corp.
General Electric Co.
Carbide & Carbon Chemicals Co.
Iowa Illinois Gas & Electric Co.
Standard Oil Co. of New Jersey
Standard Oil Co. of California
International Minerals & Chemical Co.
Celanese Corp. of America
Pennsylvania Edison Co.
A. O. Smith Corp.
Nicholson File Co.
Allis Chalmers Manufacturing Co.
Western Cartridge Co.
American Brass Co.
City of Los Angeles
Houston Lighting & Power Co.
Parke Davis Co.
Carolina Power & Light Co.
The Rubberoid Co.
Kellogg Company
Shell Oil Company
Union Electric Co. of Illinois
Curtiss-Wright Corp.

Distinctive Features of RILEY STEAM GENERATING UNITS

Special Tube Hole Grooving*

For high pressures, tube hole grooving is important. The use of small grooves, 15 per inch, gives the best seal. Tests have proven rolled joints with this type of grooving many times stronger than with the customary larger grooving. With the fine grooves, the tube metal will flow under rolling into the grooves, completely filling them with a minimum of tube thinning.

*Sole Licensee in Boiler Industry under Scovill Patents

rvey of your power plant by a consulting engineer will possibly show ways of making surprisingly large savings in power costs

OMPLETE STEAM GENERATING UNITS

OILERS • PULVERIZERS • BURNERS • STOKERS • SUPERHEATERS • AIR HEATERS
CONOMIZERS • WATER-COOLED FURNACES • STEEL-CLAD INSULATED SETTINGS • FLUE GAS SCRUBBERS

ns before purchasing Boiler or Fuel Burning Equipment

(CONTINUED FROM PAGE 95)

4 Check hose and connections for leaks

Do this periodically, dipping hose in water while it is under pressure. Use soapy water on connections. Remember that a 1/64-in. hole in a hose operating at 100 psi will waste 292 cu ft of oxygen in 24 hours—more than a tankful.

5 Select the right hose and use it right

A hose too small for the job requires higher gage pressure to insure sufficient flow. This causes unnecessary strain and promotes hose leakage. Don't use too long a hose. Extra length is cumbersome, requires more pressure, gets unnecessary wear, invites leaks. Protect hose from sparks, slag, oil and grease. Place a plank on each side of the hose where it crosses truck runways. Store hose stocks in a cool, dark place. When hose is damaged cut out the bad portion and splice the ends together with a standard splicing nipple. Remember that rubber conservation is a patriotic duty.

6 Be fair with your cylinders

Use all the gas in each cylinder. Order fewer cylinders oftener. Return empties promptly; others may need them. Idle cylinders serve no purpose; keep 'em rolling. Today's war emergency requires abandoning the old custom of keeping plenty of reserve cylinders. Gas suppliers are cooperating by providing more frequent deliveries.

7 Turn off the gas

Don't let torches burn unused. Even three minutes needless burning out of each hour means a 5% gas loss. Oxygen is precious now; don't waste it.

MORE POWER FROM EXISTING EQUIPMENT—4

Practical suggestions for increasing capacity quickly and with minimum use of strategic materials

HOW TO GET THE MOST OUT OF DIESEL AND GAS ENGINES

By L N ROWLEY
Associate Editor

High efficiency and accurate ratings characteristic of modern engines and accessories put emphasis on intelligent operation and maintenance to realize the full capacity built into the equipment. Here's a check list for operators, with suggestions for increasing capacity in some cases

▶ The *actual* capacity of an internal-combustion engine may be considered as the load at which the exhaust becomes smoky. The *rated* capacity is usually somewhat less. For example, the DEMA Standards define rating as the net bhp the engine will deliver continuously when in good operating condition and located at an altitude of not over 1500 ft above sea level, with atmospheric temperature not over 90 F and barometric pressure not less than 28.25 in. Hg. This standard rating must allow for operation at 10% overload for two out of any 24 hours, with safe operating temperatures. Taking into account the allowed overload and the allowance for unfavorable conditions of altitude, temperature and pressure, such an engine might be good for about 15-20% overload for short-time peaks, under favorable conditions.

Since capacity rating depends on BMEP and combustion conditions, it would seem simple to increase output by stepping up the rotative speed. This means higher piston speeds and greater inertia forces; in other words, more strain on working parts. Within reasonable limits, speed may be boosted safely, and this way of increasing capacity offers some possibilities where engines are not connected directly to synchronous machinery. Speed must be kept at least 10% away from peak of any injurious critical. Before any such change is made, the manufacturer should be consulted; his engineers know the design factors involved. Remember that friction increases with speed so that gain in capacity is not proportional to increase in rpm; for example, a 25% speed increase would only mean about 20% capacity gain.

In some cases, supercharging will step up capacity 25 to 50%. In simplest terms, supercharging crams more air into the cylinder each cycle and thus permits burning more fuel. Mean effective pressure is higher, but by lowering the compression ratio, the increase in maximum cylinder pressure can be held down. Likewise, in a supercharged engine total heat of combustion increases, but more waste heat goes into the exhaust and less into the jackets. If exhaust temperature is unchanged, it may be assumed that temperature stresses in the engine have not been increased. The amount of supercharging permissible depends largely on the engine design and will be greatest in older engines of conservative design. Only the manufacturer's engineers can evaluate these factors.

In most cases, supercharging involves increasing the rate of fuel injection (may mean new pump and nozzles), changing timing to allow for overlap to scavenge clearance volume, and checking capacity of governors, cooling system and other parts affected by a major increase in output. A small amount of supercharging may be effected without changing injection equipment or cams.

There are four basic ways to drive a supercharging blower: (1) by belts or gearing from the engine, (2) by a separate motor, (3) by an exhaust-gas turbine, and, (4) by a steam turbine supplied by a waste-heat boiler. Motor-driven and exhaust-gas-turbine superchargers have seen most use in this country. The motor-driven arrangement

is simple and flexible and can be adapted readily to existing equipment. Where field conditions permit the necessary piping changes, the exhaust-gas turbine offers a compact and efficient hookup, using waste power in the exhaust to provide the supercharging.

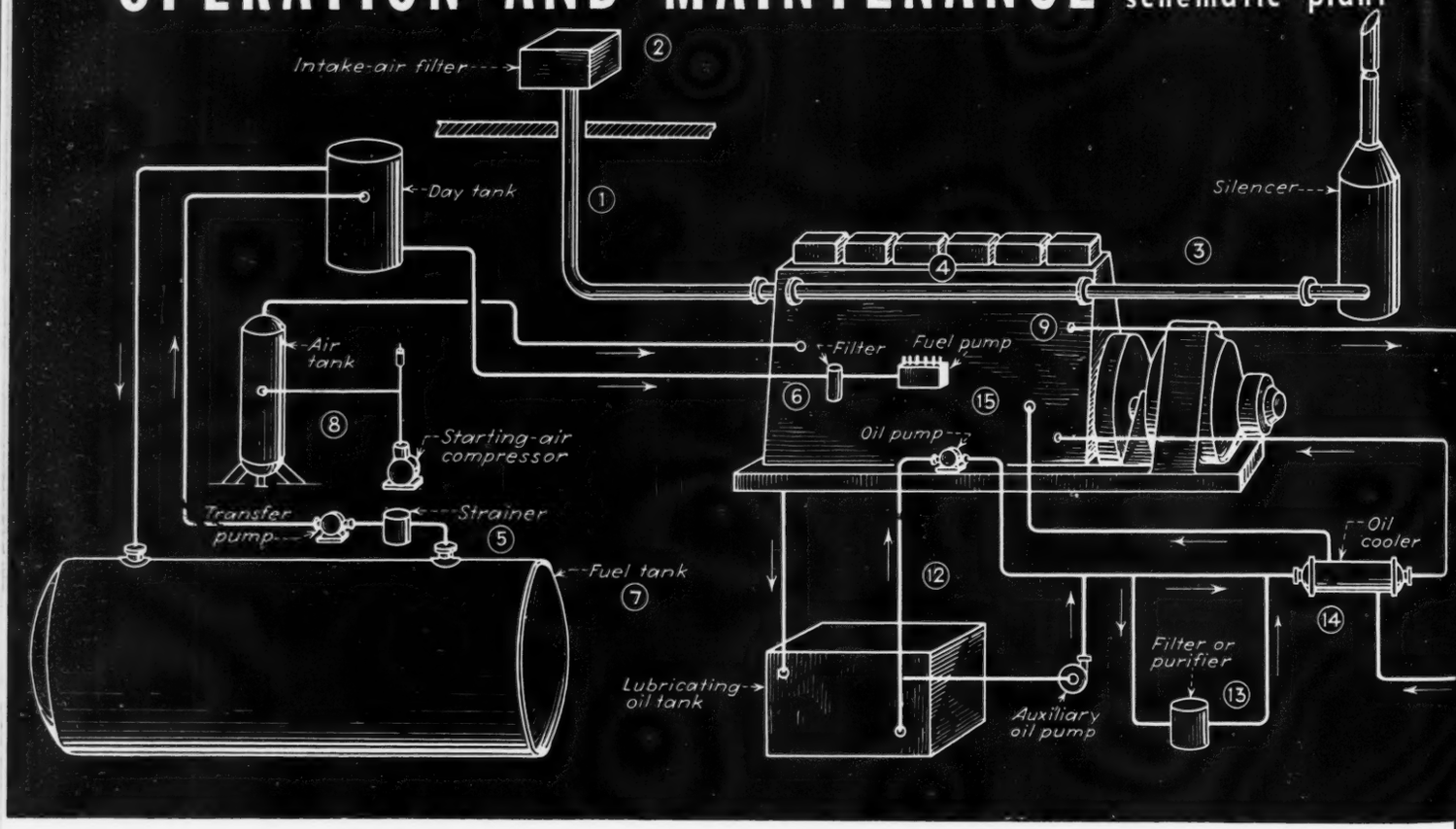
The above represents only a bare outline of the still not-too-well-known factors involved in supercharging. It can be summarized as follows: if you operate conservatively designed heavy-duty 4-cycle diesels and need up to 50% more output consult the maker; it may be quicker and cheaper to supercharge than to install new engines.

Since many older diesel and gas engines were built, major improvements in parts and accessories have been made. In many cases, efficiency, reliability, and capacity can be improved by "modernizing" old and still-serviceable units. At least one manufacturer has designed engines so that as improvements are made they can be incorporated in existing engines.

Waste-heat recovery may contribute to plant improvement by making available hot water or steam for process work. Steam from waste-heat boilers may be used to drive low-pressure turbine-generators supplying power to auxiliaries or to the main bus.

OPERATION AND MAINTENANCE

Numbers on this schematic plant



▶ From the foregoing it can be seen that the high efficiency and close rating of modern diesel and gas engines precludes any sensational capacity increases in the majority of cases. This puts it squarely up to the operator to get out of his equipment the performance that is built into it—to realize the maximum safe capacity when needed for peak loads and to keep engines on the line, rolling out the steady stream of kilowatt-hours needed to win the war.

Getting the most out of an existing diesel or gas-engine plant means: (1) investigation of plant layout to spot and remove limitations that may prevent attaining full capacity, (2) intelligent operation and maintenance to realize maximum output and efficiency, and, (3) systematic inspection to detect conditions that might cause sudden outage and loss of vital output.

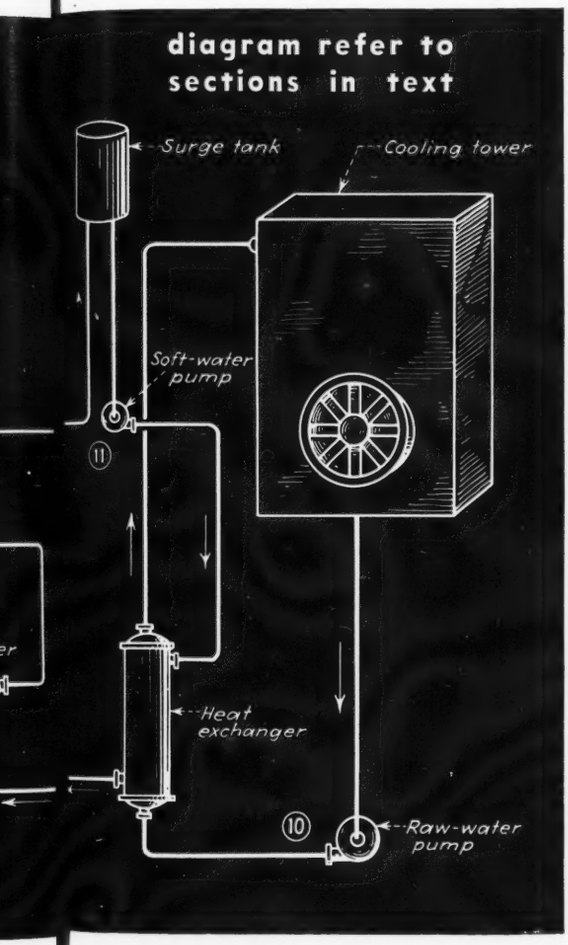
With the schematic plant diagram (above), as a guide, let's look at each section of the plant for places where small capacity limitations may lie and for spots where operation and maintenance seriously affect efficiency, capacity or reliability. Many of the points listed below apply to both diesel and gas engines, some to diesels only.

Intake systems (1) must deliver an *ample* supply of clean air for combustion; lack of air reduces capacity. Check piping for excessive pressure drop, eliminate bends and fittings, shorten piping runs wherever possible, and use largest economical diameter of pipe. Avoid preheating of intake air.

Air filters (2) must protect engine against wear-producing dust and dirt without seriously increasing resistance to intake-air flow. This means regular cleaning according to a schedule determined by experience or according to pressure-drop measurements. *Dry* filters have low initial resistance which rises rapidly in service; units should be cleaned (vacuum or compressed air) when pressure drop reaches 0.5 to 1 in. H_2O. Use dry cleaning for oily dusts. *Viscous* filters have higher initial resistance, which rises slowly. Pressure drop of 4-5 in. H_2O indicates a full dust loading and little more effective cleaning can be expected. Wash dirty cells in hot water, dip in filter oil and drain for 12 hours before returning to service. *Automatic-viscous* and *oil-bath* filters

are characterized by more or less constant pressure drop; remove sludge from oil and maintain proper oil level.

Exhaust piping (3) must also be arranged for minimum pressure drop. High backpressure reduces amount of expansion on power stroke and prevents maximum air intake on suction stroke. Backpressure should not exceed 2 psi and preferably should be considerably



less. See that it is impossible for water, from leakage, rain or snow, to flow back to the engine. Clean exhaust pipes and waste-heat equipment regularly; deposits represent a serious fire hazard and reduce heat transfer.

Exhaust temperature (4) measured at connection between individual cylinders and manifold, should be read regularly. Differences between cylinders indicate unequal loading or combustion irregularities. Low temperature may indicate lack of fuel, poor spray-nozzle action or low compression pressure, probably caused by blowby. High temperature may indicate heavy cylinder loading, delayed combustion or scale in jackets. Inspect pyrometer elements regularly; if dirty they will read low.

Fuel filters and strainers (5, 6) protect against the impurities found in both liquid and gaseous fuels. Be sure they are big enough for the job and inspect them regularly. Match frequency of inspection to character of fuel. Heavy, low-grade fuels should be centrifuged and preheated; insulate lines so that excessive heating is not needed to deliver oil to injection pump at right temperature. Head must not be so high as to create vapor lock.

Fuel tanks (7) should be cleaned at least once a year; oftener if fuel is dirty or contains water. Check for corrosion and, if steam heating-coils are installed, check for leaks.

Starting-air systems (8): inspect starting valves at least once each 4000 hours; grind carefully if needed. Check receiver at least once a year for signs of corrosion or structural weakness. A separator on the compressor discharge will trap moisture and lube oil; a filter may be needed on compressor suction in dusty locations.

Jacket-water temperature (9) should be held to range recommended by engine builder; in absence of recommendation set outlet temperature at 130-150 F (150 F for high-speed units). Regulate jacket flow to keep temperature rise to 10-20 F; this makes turbulence in water spaces, prevents local hot spots and decreases temperature difference between top and bottom of cylinder. Excessively high outlet temperature may cause breakdown of protective oil film; low temperature causes incomplete combustion and condensation on lower cylinder walls, a common cause of liner wear, particularly in gas engines. In general, it is better to lean toward high jacket temperatures rather than low.

Scale in jackets leads to overheating which causes "growth" of cylinders and pistons, scoring, warping, cracking and burning. Watch exhaust areas for first signs. Scale also reduces heat transfer in heat exchangers. In addition to scale-forming substances found in most natural waters, impurities such as oil, mud, and animal or vegetable matter will cause overheating and lowering of heat-transfer rates.

Where raw water is used in jackets, keep water temperature at or below 140 F and if water is high in scale-forming substances treat with zeolite or other recommended methods. Best solution lies in use of "closed" or double-circuit cooling system in which soft water circulates in jackets. Even in this case some makeup is required and scale may tend to form, particularly on the raw-water side of heat exchangers. Amount of treatment required is, however, drastically reduced and in many cases eliminated. To remove accumulated scale from a system, use an inhibited acid or other commercial scale-remover. Follow maker's instructions.

To prevent corrosion, keep pH of jacket water high (9 or over) and avoid entrance of air into the system as far as possible. Oxygen scavengers such as sodium sulphite may be added to neutralize oxygen that cannot be eliminated. In some areas, algae growth may occur in cooling-tower basins and spray ponds. Copper sulphate is cheapest remedy where effective, but chlorine is better. In recirculating systems chloramines, sodium pentachlorphenate and other proprietary compounds prove effective. (See POWER, Feb. 1939, pg 91; March 1938, pg 136, 137). Filtration will remove *suspended* matter as distinguished from *dissolved* scale-forming solids.

Piston cooling must be maintained. If oil is used watch pressure to be sure it is adequate to force oil to piston; if water is used, watch for leakage which will contaminate lubricating oil.

Raw- and soft-water pumps (10, 11) should be carefully maintained. Check condition of impeller vanes and wearing rings, shaft sleeves, packing and water-seal rings. Change bearing oil in both motor and pump regularly; maintain grease-lubricated bearings properly (see POWER, May 1941, pg 110; June 1941, pg 109-110). Check suction lines for trouble spots: insufficient head, too-high temperature, spots where air accumulates. Put air vents on all pumps and at high spots in lines. Watch for leaks on suction side that admit air to the system.

Lubrication systems (12) vary with the engine but cleanliness is absolutely important. If there is no purification equipment, drain crankcase sump and supply tank, remove all sediment, remove and clean suction pipe and replace used oil with new. Do this at intervals recommended by engine builder or oil supplier. Even on systems provided with purifiers, clean out the entire system, including piping, at time of major overhaul.

Oil filters and purifiers (13) remove contamination occurring in oil under service conditions, protecting the engine and saving oil. These may be arranged for continuous full-flow, con-

SUGGESTED INSPECTION AND MAINTENANCE SCHEDULE

These recommended maximum operating hours between inspections will serve as guides. The actual schedule for any engine should be based on the manufacturer's recommendations and on the user's own experience

ITEM	OPERATIONS	HOURS
Spray checks	Test tightness each time unit is shutdown	
Air tanks	Drain water, oil	200
Cylinder-head jackets	Inspect and clean	750
Exhaust valves (4-cycle)	Clean and grind	750
Spray nozzles and atomizers	Inspect, clean, adjust	1250
Inlet valves	Clean and grind	1500
Lubricating-oil piping	Inspect for leakage, loose joints	1500
Pistons, rings (2-cycle crankcase scavenging engines)	Pull, clean and inspect	3000
Exhaust-port bridges (2-cycle)	Check and relieve if necessary	3000
Crankpin bearings	Check and adjust	3000
Main bearings	Check alignment	4000
Air-starting valves and checks	Clean and grind	4000
Camshaft gears or chains	Check and adjust if necessary	4000
Fuel pumps and fuel systems	Inspect, clean and adjust	4000
Lubricating-oil pumps	Inspect	4000
Cylinder jackets	Inspect and clean	4000
Pistons, rings (2-cycle engines with scavenging pumps; 4-cycle)	Pull, clean and inspect	6000
Wristpin bearings	Check and adjust when piston is pulled	
Governor	Inspect and adjust	8000
Main bearings	Check and adjust	8000
Lubricating-oil tanks, lines, and passages	Clean	8000

tinuous bypass, and batch operation (see POWER, Jan. 1941, pg 14–17; Feb. 1941, pg 78–80, for details on equipment and methods of use). Whatever the equipment, use it intelligently and check results by having oil supplier analyze used oil at regular intervals.

Oil coolers (14) keep oil at proper temperature (shouldn't exceed 150 F). High temperature tends to increase leakage from crankcase, increasing consumption, and accelerates oxidation and sludge formation. Any increase in crankcase temperatures may indicate a hot bearing and should be investigated. Inspect oil cooler regularly for scale on water side and sludge coating on oil side; use inhibited acid on water side. Oakite on oil side (see POWER, June, 1941, pg 438).

Oil pressure (15) must be watched carefully; provide automatic alarms if possible. Investigate immediately sudden pressure changes which may mean a break in the system. Increased pressure usually means clogging; a slow fall of pressure usually indicates bearing or pump wear and a sudden drop means a burned-out bearing. Blue smoke in exhaust indicates excessive oil; adjust oil pressure or rate of cylinder feed. Check for faulty piston rings or mechanical defects if oil feed is right.

Nozzles, spray valves: use test pump and gage to maintain nozzle adjustment. Keep holes in tips free from foreign matter; black exhaust and vibration indicates clogging. Keep extra nozzles or tips on hand, ready for service. Keep spray valves tight and free from leaks; leaky valves cause afterburning, rise in exhaust temperature and overheating of exhaust valves.

Inlet and exhaust valves: feel inlet-air and starting-air pipes near cylinder heads at regular intervals during day. Warmth indicates leaky valve. In some cases valve may be made to seat properly by twisting several times; if not, shut down as soon as possible.

Keep spare valves on hand. Lubricate exhaust valves with mixture of kerosene and thin lubricating oil (too much lubrication is worse than too little). Avoid excessive exhaust temperatures, caused by overloads, slow combustion or incorrect valve timing; high temperatures burn valves. Can interchange inlet with exhaust valves to let burn clean. Grind valves with fairly soft wheel using a jig or fixture.

Cylinder liners: inspect regularly for cracks. Bolt down heads evenly to avoid strains. Keep circulating pump running 15–30 min after engine is shut down or if pump is engine driven, run engine at no load. Liners must fit accurately at top and bottom. If one liner shows cracks, check all others.

Combustion: where possible check combustion conditions by taking indicator cards once a week; if regular indication is impractical, read exhaust temperature regularly and plot fuel consumption against load. Maintain combustion pressure at highest permissible figure and see that combustion is completed as soon as possible in the piston stroke without exceeding the maximum combustion pressure. Watch compression pressure as a check on mechanical condition of piston rings and cylinder wall and on lubricating-oil-film condition. If engine is in good mechanical condition and compression pressure is lower than it should be, bring it to proper level by inserting shims under the connecting-rod foot.

The key to good operation and maintenance is regularity—establish sound procedures and stick to them. When engines are running, inspect them hourly, looking for leaks, listening for mechanical noises, checking temperatures by feel. Adopt practical daily and monthly log sheets and fill out carefully.

Establish and follow a schedule for inspection and routine maintenance (see the suggested recommendations above). Regular inspection of this kind detects and cures troubles while they are still small.

INSTALLATION TABLES

Since 1932 POWER has published annual tabulations of the engineering features of new diesel and gas-engine plants. These have been made possible by the helpful cooperation of the engine builders. Now, with the diesel and gas-engine industries producing almost exclusively for the war effort, continuation of the tabulations becomes impossible.

When information of this kind can be again released, we will resume the tabulations and, if possible, will review the installations made during the war years.

How To Install Foundation Bolts

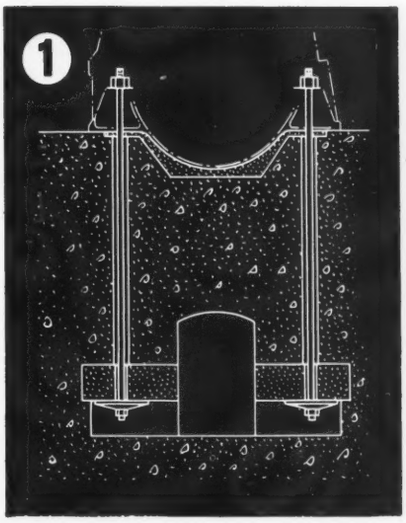
Insuring proper lineup of bolts and base-plate holes eliminates erection delays and troubles. Arthur H Korn gives practical pointers on setting both sleeves and solidly imbedded bolts

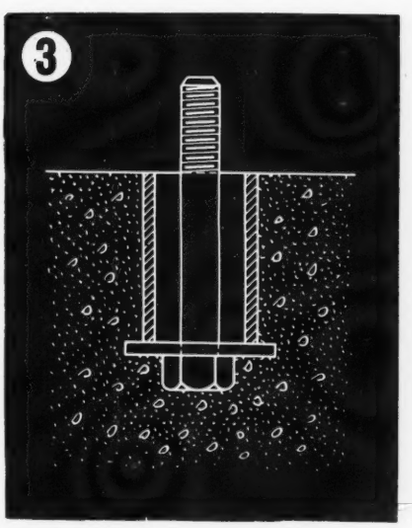
▶ MOST LITERATURE on foundations covers determination of mass required and methods of dampening and absorbing vibration. As for methods of setting foundation bolts, good and bad ones are found in equal numbers. This is not surprising, since foundation bolts, anchor plates, sleeves and so forth generally are not furnished by the machine manufacturer. It is usually more convenient to secure stock and make them up locally. Therefore they do not receive the constant improvement and development of a manufactured product. Experiences and knowledge gained in isolated cases would provide valuable data for future need if a practical method of collecting it was available.

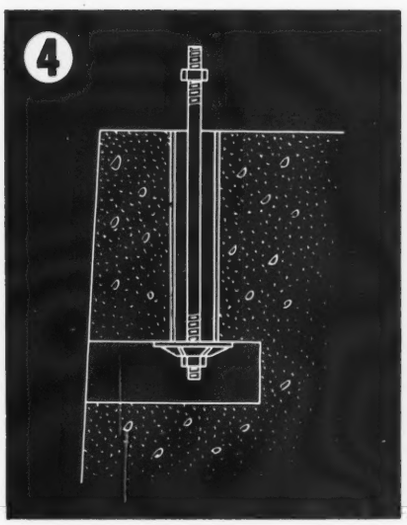
Fig. 1 shows the foundation of an 800-hp diesel engine with tunnel access to the lower ends of the foundation bolts. Making bolts for heavy machines of this kind removable eliminates the difficulty encountered in lowering the engine down over the bolts. Foundations of this size are designed by specialists and need not be elaborated on.

Foundations for smaller machines use a bolt which permits springing slightly in any direction to align with the machine casting, Figs. 3 to 6, and Fig. 9.

The writer, in the employ of the manufacturing concern, not infrequently would receive a telephone call from a customer saying "Why do we have to go to all the trouble of setting foundation bolts to allow for variations in the casting? It will require an expert to do the form work and the foundation will cost us more than your machine. As the machine casting is in your shop take the measurements and let us have the actual center distance between the holes, so that we can set the foundation bolts correctly, presumably Fig. 2, without needing to make allowances for shop or foundry mistakes." Indeed, the argument is hard to refute. The fallacy lies in the misconception of the reason for an adjustable bolt setting. Placing the blame on the casting overlooks the fact that the bolt-hole centers in the casting vary little, if at all. Cored holes in castings are usually $\frac{1}{8}$ in. larger than the bolt diameter. Drilled holes in rough work, such as structural steel, are generally $\frac{1}{16}$ in. larger than the bolt diameter, while in ordinary machine work $\frac{1}{32}$-in. difference is ample. Now, assuming the holes to be $\frac{1}{8}$ in. larger than the bolts and the casting to be absolutely accurate, the foundation bolts would have to be set with a tolerance of less than plus or minus $\frac{1}{16}$ in., not only on the two center distances at right angles to each other, but also on the diagonal. A carpenter simply cannot work to such a degree of accuracy. It is doubtful whether the folding rule he uses is precise within such limits. The writer once saw a demonstration in which a new 6-ft folding rule was stretched almost $\frac{1}{8}$ in. by lightly tapping the joints with a hammer. Besides, there are other factors to be considered such as warping of the shuttering, template twisting or going out of







square, even if it has diagonal bracings, causing shifting of the bolts when the concrete is poured.

Even with the sleeve settings, Figs. 3, 4, 5, 6 and 9, the bolts should be set accurately; otherwise they will have too much slant when sprung into place and the nut will have no true bearing on the machine base. This is true particularly if the bolts are short, Fig. 3, or if the lower end of the bolt is fixed rigidly in the concrete, Figs. 3, 5 and 6.

The drawing, Fig. 2, has been published many times since the days when machine foundations were generally built of brick. But it has never been revealed how the bolts could be set in that manner with any degree of accuracy, either in brick or concrete. They certainly cannot be left dangling loosely from the template when the concrete is poured. The rigid imbedding of the bolts in the concrete of Fig. 2 and 8 are also inferior because the bolts lack resilience. Bolts fixed at the lower end only can stretch more and are less liable to crystallize at the root of the threads.

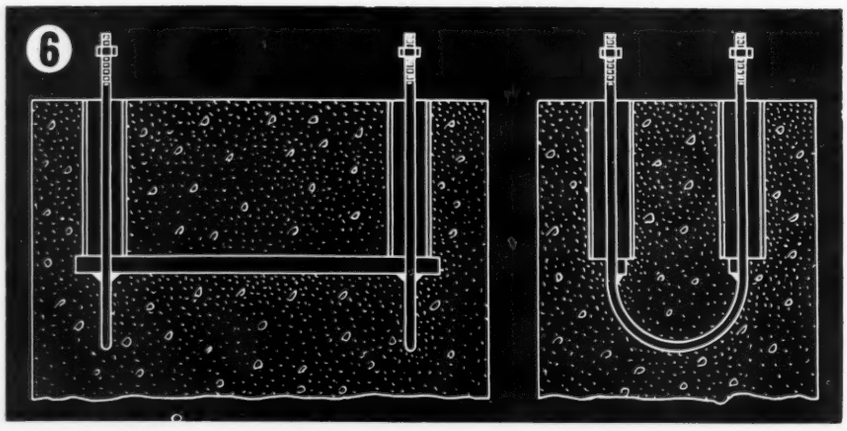
The sleeve setting, Fig. 3, is of doubtful value. In the proportions shown its length does not permit much springing of the bolt and thus misses the most important reason for its use. Fig. 5 is another bad example found in books and catalogs. It is impossible to execute because sleeves will not defy gravitation but must be fastened in some manner. In more than one case they were tied to the template with strings.

Another design is shown in Fig. 6 where pairs of U-bolts support the pipe sleeves by flat steel bars tack-welded to them. If welding equipment is available this should make an inexpensive, simple and sturdy job that cannot easily be forced out of shape. If a cast-iron anchor plate is used, its full possibilities may be realized without allowing for handholes to get at the lower nut, as shown in Fig. 4. There is no good reason for having nuts at the lower bolt ends because they create a locking problem. A removable bolt design is shown in Fig. 9. Plates and bolts should be designed so that the bolt head can be introduced from the top through a slot in the plate, to take a seat in a recess provided at right angles to the slot. This will prevent the bolt from turning. Bolts of the required length are not always available, and it may be more expedient to thread steel rods at both ends. One end of the bolt can be screwed into a steel bar and secured by welding or riveting; the plate should have a lip to center the bolt sleeves. The form work problem presented by the pocket below the plate may be obviated by giving the plate the form of an inverted cup.

Inside pipe-sleeve diameter should be approximately 1-in. greater than the bolt diameter. Square the sleeve ends so they will assume a vertical position when held by the level template. One arrangement, shown in Fig. 8, can be used where the bolts are installed at the same time the machine is placed on the foundation. In this case cross bars should be welded to the bolt to keep it centered in the hole while the grout is being poured.

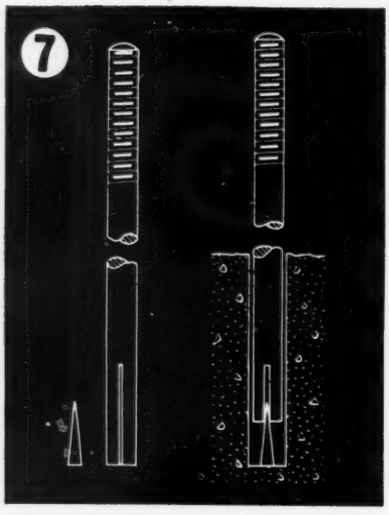
After the machine or machine base has been placed on a foundation, it should be leveled carefully by driving steel wedges under it, thus raising it at least $\frac{3}{4}$ in. above the concrete surface. Some authorities would allow $1\frac{1}{2}$ in. in order not to run the risk of having to chip the uneven concrete surface in some places. Provision must be made when grouting to prevent the grout from entering the sleeve. Draftsmen are inclined to call for only the theoretical minimum length of threads on anchor bolts. At the very least 1 in. additional length of thread should be provided. Threaded portions too long do no harm, while bolts threaded too short may cause inestimable expenses. Threaded portions at least 6 in. long have been demanded.

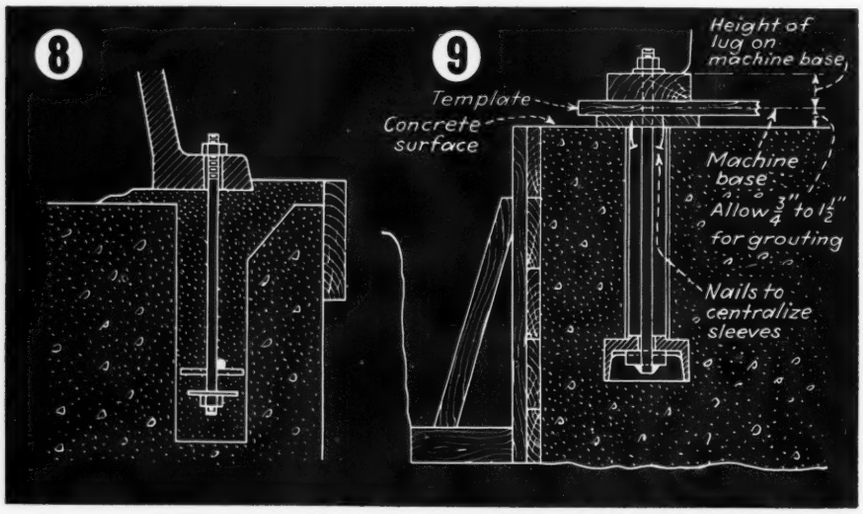
When machines are to be placed on old concrete, bolts similar to those shown in Fig. 7 can be used if regular expansion bolts are not available.

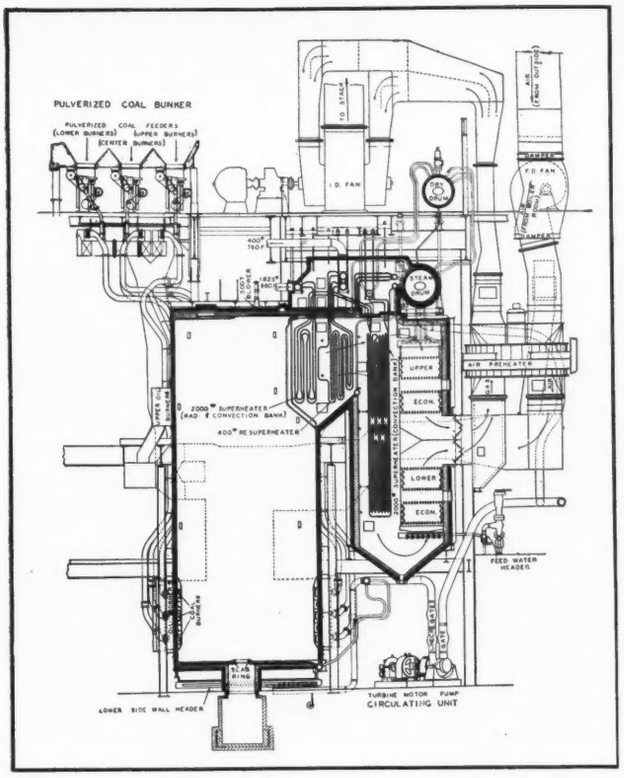


Correction

In the article describing the new Crawford Clothes plant (POWER, May 1942, pg 68) a typographical error resulted in the failure to list Huxley Madeheim, consulting engineer, and J F MacGowan, chief engineer.







Controlled forced-circulation boiler at Somerset Station (Montaup) delivers 650,000 lb steam per hr at 1625 psi, 960 F

As president of Illinois Institute of Technology, sponsoring institution, H T Heald opened the Midwest Power Conference

Good Water Treatment Helps Meet War Loads in Small Plants

Getting more out of the old "kettle" depends on conditioning it against outages; Somerset boiler design, new spreader stokers at Studebaker also discussed at Midwest Power Conference

▶ STRESSING WARTIME PROBLEMS, but also covering a wide variety of other questions of interest to power designers and operators, the Midwest Power Conference met in a 2-day session at Chicago's Palmer House, April 9–10.

As usual, the Illinois Institute of Technology sponsored the conference with the cooperation of nine other Midwestern universities and colleges and the local sections of seven engineering societies. H T Heald, president of Illinois Institute of Technology, delivered the address of welcome.

Responding for the other cooperating institutions, Dean A A Potter of Purdue University urged all to "pull together to insure victory in our struggle against the wrong ideology of totalitarian racketeers."

Discussing prevention of steam losses and fuel waste in the present emergency, V G Leach, chief combustion engineer, Peabody Coal Co, said that more than 35,000,000 tons of fuel will be wasted in this country in 1942. This is equivalent to a year's employment of 22,000 men and 28,000 coal cars. He urged frequent plant inspections by competent combustion engineers who could recommend savings.

At the session devoted to central-station practice, papers were presented by F H Rosencrants, vice-president of Combustion Engineering Co, and by E G Bailey, vice-president of Babcock & Wilcox. Mr Bailey's paper, which listed ways to get more output from boilers, was abstracted in May POWER.

Mr Rosencrants reviewed the features of the Combustion Engineering controlled forced-circulation steam-generating unit at the Somerset Station of the Montaup Electric Co. This unit, described in January POWER, has gone into operation since the Midwest Power Conference. Rated at 650,000 lb per hr, 1625 psi and 960 F, the unit is tangentially fired with pulverized coal, and employs a slagging-bottom furnace.

Except for the convection surface represented by the 2-stage superheater, the reheater and economizer, all the heat-absorbing surface is radiant. Furnace tubes are 1¼ in. diameter, permitting thin walls. There are three circulating pumps (two for normal operation and one spare) operating at a differential pressure of 40 to 50 psi—enough to overcome the resistance of

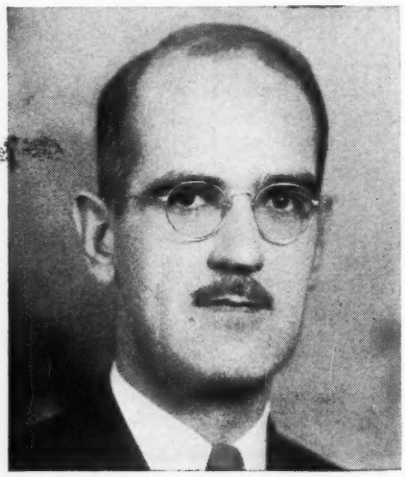
the circuit and the drop through the orifices. Water handled by these pumps (which are distinct from the boiler-feed pump) is several times the steam-production rate of the unit.

Water Problems of Small Plants

The water problems of small power plants were reviewed in an extensive paper by E P Partridge and A L Soderberg, both of Hall Laboratories. The paper was presented by Dr Partridge. Following is a summary:

In the days of World War I, the almost universal cause of overheating was scale—a compact insulating layer of calcium sulphate, carbonate or silicate. No plant today need be troubled by such scales. If they deposit it is proof that scientific water conditioning has not been applied to the limit.

R N Bucks of Studebaker reported fine overall results with new stoker burning low-grade screenings



Dr E P Partridge of Hall Laboratories showed how better boiler-water conditioning can help small plants

In many a plant in the past it has not seemed necessary to go to the limit in treatment. Today, however, capacity is being stretched in plant after plant. With higher heat inputs, calcium-carbonate scale develops in spite of soda-ash conditioning, forming most rapidly in those regions where any resistance to heat transfer will cause the maximum increase in metal temperature. Without more advanced water conditioning, the engineer then has the hard choice of taking the boiler off the line for more frequent cleaning or of having it come off at some particularly inconvenient moment with a ruptured tube.

What can be done to meet this demand for a few more pounds of steam from the old "kettle," a demand that is bound to grow in plant after plant until after the war? Even the best lime-soda softening won't prevent the formation of calcium-carbonate scale on hard-worked heat-transfer surfaces. By using a second stage of softening, in which sodium phosphate is added, the amount of calcium ion left in feedwater may be still further reduced by its removal as calcium phosphate, but subsequent treatment with acid is desirable to prevent accumulation of this substance in the lines between softener and boiler.

Base-exchange softening, using properly balanced hydrogen and sodium cycles will accomplish the same general results as lime-soda softening, and it can be operated to yield a feedwater containing even lower residual concentrations of calcium and magnesium ions. An economic balance usually favors lime-soda softening for waters high in hardness but base-exchange on the combined hydrogen and sodium cycles for those low in hardness.

While proper conditioning can prevent boiler scale of the traditional variety, and can control sludge so that it will not interfere with heat transfer, it cannot keep tubes from overheating when circulation is inadequate. Keeping the heat-transfer surfaces in a boiler adequately cooled is a joint problem for the mechanical engineer and the chemical engineer. An overheated boiler tube can suffer accelerated oxidation. The cure is to insure the flow of cooling fluid past the surface at a sufficiently high rate.

Spreader Firing at Studebaker

Despite many factors restricting its original design, the steam-generating unit built for the Studebaker Corp in South Bend in 1940, has turned in an extraordinarily good performance, according to R N Bucks, power superintendent. It was necessary to install the plant in a building originally designed for much smaller boilers, and also (the management insisted) to provide for the burning of any available fuel, particularly the nearby low-grade Indiana and Illinois screenings—coals with a heating value as low as 10,000 Btu per lb. Although the new boiler could be allowed only 400 sq ft of grate surface (because of building-column arrangement) the boiler would have to supply 175,000 lb per hr continuously and 210,000 lb for 4-hour peak load.

"We went at the problem backward by designing the furnace first and building the boiler around it," said Mr Bucks. "We could not make the space wider; we could not stretch it longer; we could not go down, but we could go up through the roof."

Assuming 11,500 Btu coal, it was necessary to figure on a 4-hour burning capacity of 65 lb per sq ft. The firing unit installed was a Detroit Rotograte stoker, a spreader unit with continuous ash discharge. This stoker runs "backward"; the traveling grate discharging the ashes at the front end of the boiler directly below the coal feeder.

The stoker has six overthrow coal-feeding units mounted at the boiler front. These spread the fuel evenly over the entire grate surface, the rate of feeding being varied automatically in accordance with the load. The ash is always at the bottom, with a thin fire on top, so that the grates are insulated from the heat and are cooled by the forced-draft air supply.

The boiler, "built around" the furnace, is a Foster-Wheeler 3-drum unit with 45% black surface in the furnace. The unit was designed for operating conditions of 225 psi and 520 F. Other equipment includes an American Blower Co cinder-separating induced-draft fan and Bailey combustion control.

To get adequate furnace volume the boiler was pushed right up through the roof, setting it 21 ft from center line of mud drum to firing floor with an average of 30 ft of flame travel to the entering tube surface. The furnace volume of 9700 cu ft yields a heat release of 29,100 Btu per cu ft per hr at peak.

The new unit was put on the line Nov 11, 1940, and has operated almost continuously since. There have been six outages of two days each for inspection and cleaning. Total coal burned in this unit exceeds 50,000 tons and has come in the main from various Illinois and Indiana mines.

For 1941, according to Mr Bucks, the annual efficiency, including standby losses, corrected for blowdown and covering a load range from 35,000 lb to 225,000 lb of steam per hour, was 82.4%. Annual average CO_2 at boiler exit was 13.5%. Mr Bucks said maintenance cost of stokers has been trivial —no replacements except shear pins.

THE OPERATING ENGINEER

George Edwards
Advisory Editor

PRACTICAL AIDS • MAINTENANCE HINTS • QUESTIONS—ANSWERS

PUBLISHED MONTHLY AS AN INTEGRAL PART OF POWER

Putting the "Know-Why" into Small-Plant Operation

Made with simple equipment, operating records in this 45-year-old office-building steam and power-generating plant point way to efficient, reliable and low-cost service

DOES A POWER PLANT wear out mechanically? The answer is "No," if the equipment is properly operated and maintained. This can be substantiated by any one of several plants that have long records of efficient and reliable operation. One of these, in the 19-story Washington Life building, 141 Broadway, New York City, went into operation 45 years ago. It is still in excellent condition and giving a good account of itself for low-cost operation and 100% reliable service.

Three longitudinal-drum, marine-type, water-tube, hand-fired boilers operate at 125 psi (designed for 200 psi and now good for 160). One of these boilers has 143 tubes arranged 13 wide by 11 high, and 2630 sq ft of steaming surface. The other two have 110 tubes each, arranged 10 wide by 11 high, and 2000 sq ft of steaming surface. Daily steam requirements reach a maximum of approximately 13,000 lb per hr and can be handled by any two boilers.

Fig. 1—Chief engineer and building superintendent Ralph B Allen (left) and his assistant Albert Fischer are apparently studying how this year's operating cost can be kept below last year's even when prices are higher and still rising

Power is generated by two 100- and one 50-kw high-speed, engine-driven 120-volt, dc 2-wire generators. Two of the engines are automatic slide-valve units and one has a uniflow cylinder and valve gear installed about 15 years ago.

Two duplex direct-acting, 1500-gpm steam pumps supply water at 130 psi to operate five hydraulic passenger elevators and one service car. Service-water, fire and sump pumps are also direct-acting steam-driven units. The service-water and fire pumps are interconnected so that both can be used for either service. Centrifugal sump and condensate pumps are motor driven.

Operating Arrangement

During the winter months practically all exhaust from engines and pumps goes into the building heating system and for water heating. In summer most of the exhaust goes to atmosphere except that used for water heating. Thermal efficiency of the plant might be improved slightly by operating at a higher pressure, but the engines were designed for 100 psi. At 125 to 130 psi they operate smoothly and efficiently, can drive their generators overloaded and give good speed regulation. From 6:30 p.m. to 8:30 a.m. the load is light and the steam pressure is reduced to 100 psi, as this pressure meets the operating conditions better than the higher pressure during this period.

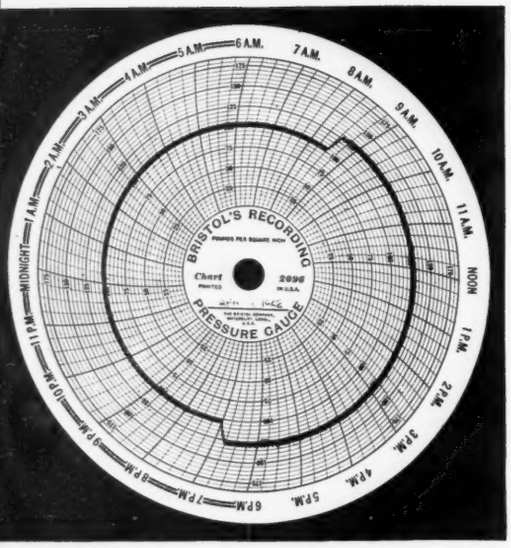


Fig. 2—Steam pressure held between 125 and 130 psi for day load and reduced to 100-105 psi for night service

Because of the heavy air-conditioning load in summer, maximum power load occurs at that time, as shown by the power curve, Fig. 3. During this period the load reaches 225 kw and requires all three generators in service or the two 100-kw machines operating overloaded, which they can do satisfactorily. In spite of operating part of the time without a spare the plant has a long record of 100% reliability.

Installation of motor-driven service-water and elevator pumps might improve plant efficiency in the summer months when there is excess exhaust steam. However, the generators do not have sufficient capacity to handle this load and the frequent starting of these pumps would impair generator-voltage regulation, which is now good. Considering the good condition in which these pumps are maintained and operated, and their high reliability, it is questionable if their replacement could be justified on a dollar saving basis, even if plant capacity permitted.

Performance Records

Much has been said about the operation of small plants and how to get fairly accurate performance records without expensive equipment. This plant is an excellent example of how it is done. The boiler room is equipped with an indicating draft gage connected with the breaching, a recording pressure gage, a feedwater-temperature recorder, a portable CO_2 meter and an automatic draft regulator. On the switchboard, a watthour meter records generator output. About 60% of the power generated is sold to building tenants and is metered. From these meter readings, the fuel weight and some estimates, a record of plant performance, cost of operation, and output distribution is obtained that has stood up through many stormy sessions.

A fairly good grade of anthracite coal, a mixture of No. 1 and No. 2 buckwheat, is purchased and delivered by truck to an enclosed bin, on a level with the firing aisle. This coal has a heating value of 13,000 Btu per lb and 12% ash as fired and is bought under a contract with a penalty clause that can be enforced if coal quality falls below specifications. This arrangement has been highly satisfactory.

From the bin, coal is weighed by volume on a truck that holds one ton when level full. This method has proved to be almost unbelievably accurate when compared to the delivery weight, checking consistently within a few hundred pounds in a month. Firing is done directly from the truck, one of its sides being dropped to form a platform at convenient height from which to shovel coal into the furnace, Fig. 5.

In the operation of the boilers care is taken to keep the settings and baffles tight and the boiler surfaces clean inside and out. Tubes are blown off once each day and the feedwater sampled and tested at 3 o'clock each afternoon except Sundays; treatment and blowdown are adjusted accordingly. In winter, when nearly all feedwater is condensate, only a small amount of treatment and blowdown is needed. In summer when feed is largely makeup, treatment and blowdown are increased, but in no case is more than half-a-glass blowdown required.

Flue-Gas Quality

Periodic checks are made of the flue-gas quality with a portable CO_2 meter. From this instrument and the draft gage a firing schedule has been developed that obtains 13% CO_2 consistently. Fig. 2 is a one-day record of steam pressure which is as nearly constant as it is possible to hold it under any condition and evidence that the firemen

Fig. 3—Month-by-month record of steam and power generation, and costs, shows low cost per kwhr for winter operation with higher cost in summer months

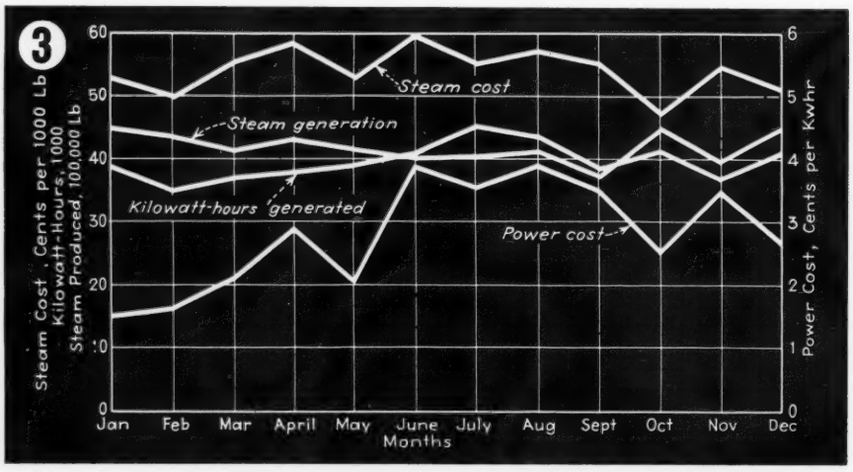
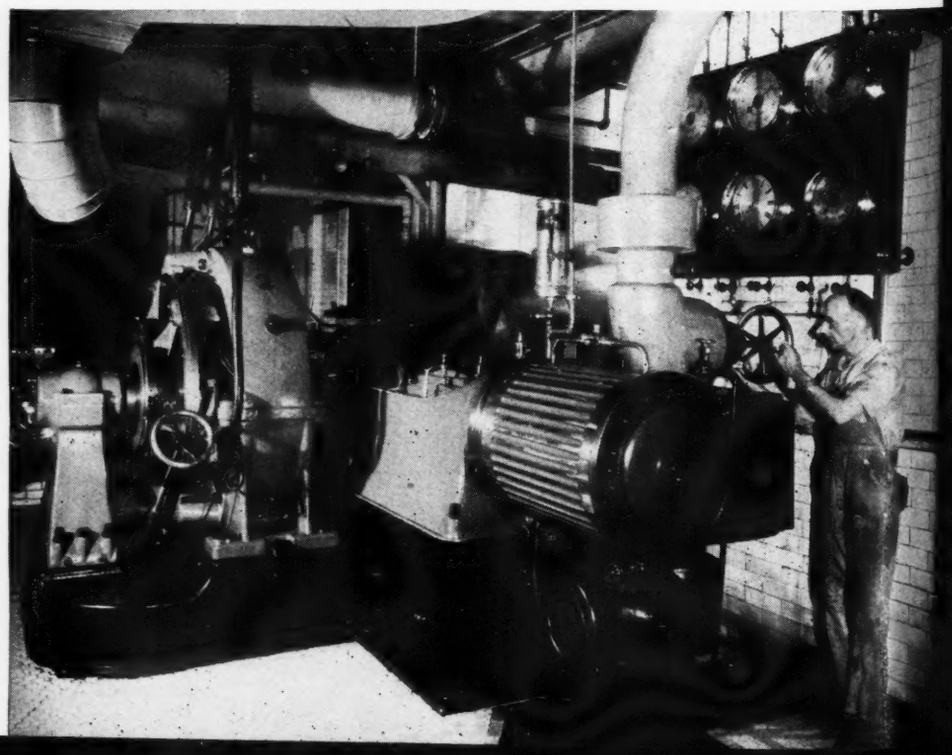


Fig. 4—One engine-driven unit with engineer Henry Wendland at the throttle



know their job and take pride in doing it.

Feedwater, which is filtered to remove every trace of oil, is heated to 212 F and metered to the boilers with an ordinary integrating water meter. This meter is read each shift and used as a measure of steam produced, to calculate the evaporation per pound of coal fired. When the boilers are blown down this amount of water is deducted from the meter reading to get the steam generated. The fireman on each shift then knows how good a job he has been doing and if a decrease in efficiency occurs the cause is located and corrected. An average evaporation of 8.5 lb of water per lb of coal is obtained.

Steam distribution is broken down into that used for (1) power generation, (2) operation of the elevators, (3) house service and (4) live-steam heating. Steam for power generation is determined by the water rate of the engines and the kilowatt-hour output of the generators. Water rates of the engines are checked at least once per year by indicating. These rates have been accurately determined in previous years by metering the steam to the engines.

Strokes of the elevator pumps are recorded by automatic counters and from these records the steam used by the elevators is determined. This system was also checked against meter records in previous years and is known to be fairly accurate. These two services account for from 75 to 90% of the total live steam, depending on the season. The rest is charged to building house service. In addition, steam sold brings in $1600 annually.

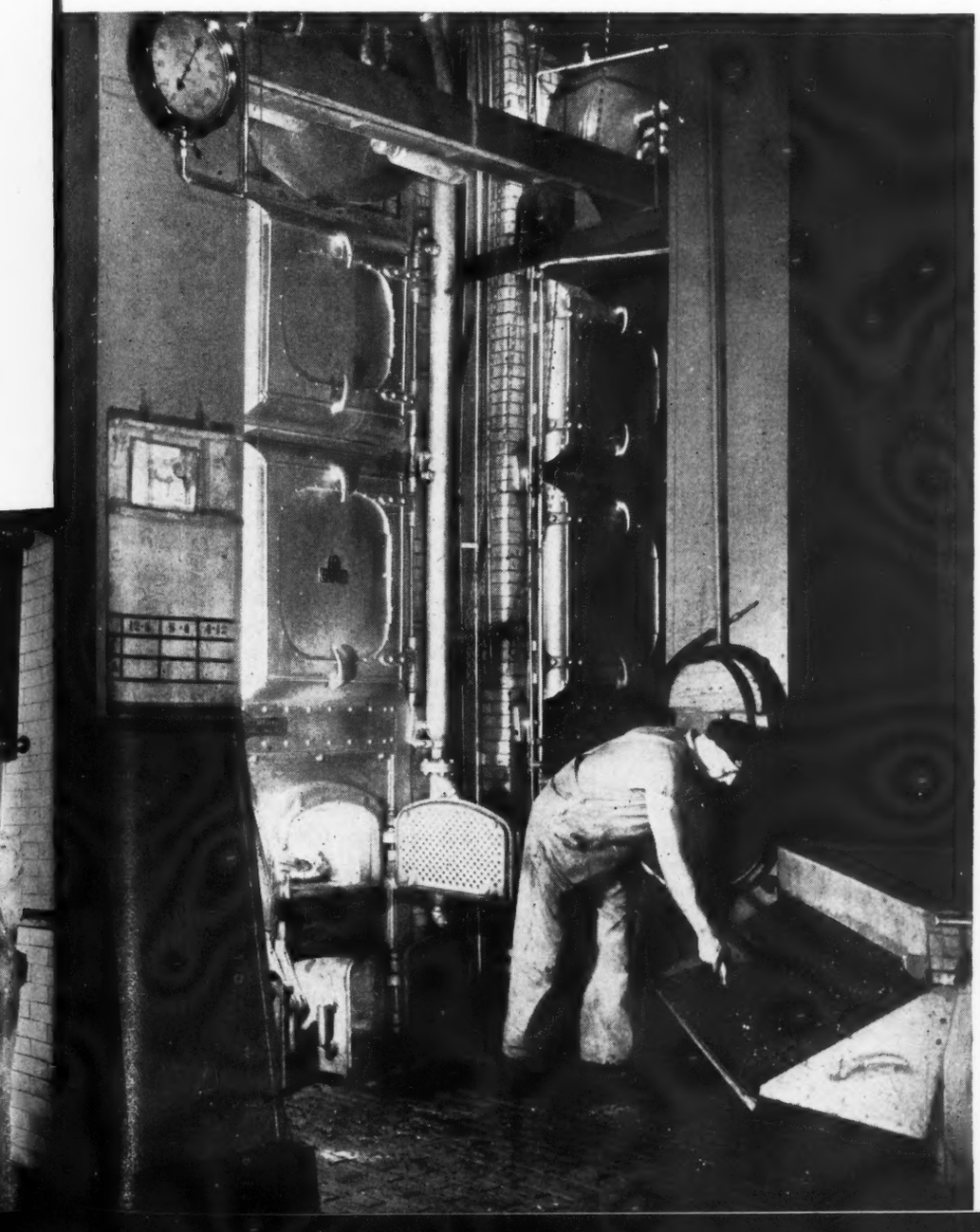
Monthly Record Curves

The curves in Fig. 3 show monthly costs per 1000 lb of steam, pounds of steam generated, kilowatt-hours generated and the cost per kilowatt-hour. The steam load remains fairly constant around 4,200,000 lb per month, reaching a minimum of 3,800,000 lb in September. During the summer months there is a large increase in power generation to handle the air-conditioning load and ventilating fans, which holds the steam requirements almost to heating-season levels. In September this load drops off before the heating load comes on and causes the lowest steam demand of the year.

The cost of steam varies widely from month to month. This is accounted for largely by the difference in the monthly cost of labor, repairs, supplies and the quantity of steam generated. Variations in labor, repairs and supplies costs in any one month may cause as much as 7 cents per 1000 lb difference in steam costs. For the year the average cost of steam is about 54.6 cents per 1000 lb.

Kilowatt-hour cost also varies over a wide range. It is low in winter months when a large credit is given for exhaust steam going to the building heating system. In the summer months, when the power load is the heaviest, no credit is given the engines for heating steam, even though some is used for water heating and part of this water is sold. Charging the power-generating part of the plant with the steam used, with labor, repairs and supplies, and crediting the engines with exhaust supplied to the building heating system results in an average yearly cost per kwhr of 2.8 cents. About 60% of the power generated is sold to tenants in the building at prevailing rates. Return from this represents a large part of the total cost of power generation, making the actual cost of operating the plant and supplying the other building services very low.

Fig. 5—Fireman Charley Olson is responsible for that good-looking pressure chart, Fig. 2, between 8 a.m. and 4 p.m., and sees to it that pressure stays right



Plant Operating Personnel

Operation of the plant is directly in charge of Ralph B Allen, chief engineer and building superintendent. The plant operating force consists of three firemen, four shift engineers and one oiler. These men, in addition to operating the plant, also maintain the elevators and do all other mechanical work in the building with exception of the plumbing and electrical work, and the replacement of the elevator hoist and counterweight cables. They are provided with a lathe, drill press, grinding wheel and an oxyacetylene welding outfit and know how to use this equipment. A carefully worked out inspection and maintenance schedule is followed so that sources of potential trouble are found and corrected before they cause an unexpected failure. Work is planned so that it is easily handled by the operators and they can take a two weeks vacation each summer for which they are paid.

EMERGENCY ROLLER BEARINGS

When your bearings fail and you can't get replacements, use this procedure for machining new ones from drill rod

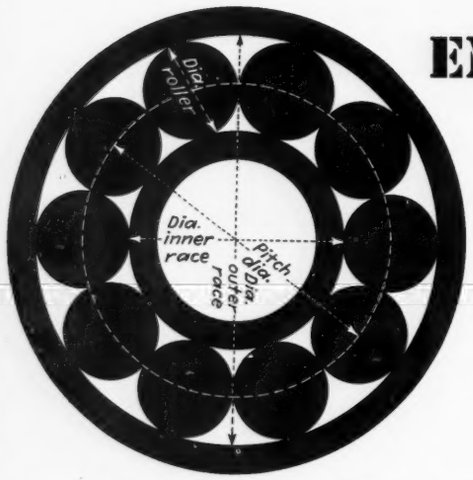


Fig. 1—Touching rollers make cage unnecessary. See table for diameters (not allowing for clearances)

UNDER NORMAL conditions there would be no need to write this article. The manufacture of roller bearings is essentially a mass-production precision technique. Given unlimited time, the average machinist could not produce a roller bearing as good as the article he could buy. And the cost might easily be several times the cost of buying the factory-made bearing.

However, there's a war on, and the editors have heard of cases where important machines were shut down because the original ball or roller bearings had failed and replacements couldn't be obtained. This article is addressed to the man who *must* have a roller bearing to keep the plant going, but can't buy one.

An item on page 91 shows how Mr Holman cut drill rod into rollers of the correct length, rounded the ends and tempered the rollers, than made inner and outer races of soft steel, later hardening their working surfaces with cyanide. Let's see what could be done with this method, starting with one of the standard sizes of drill rod. We shall discuss only that bearing in which the rollers practically fill the space, so that no cages are necessary.

Finding Dimensions

Fig. 1 diagrams a roller bearing with ten rollers. For ten rollers, not allowing any clearance, the *pitch diameter* of the bearing (that is, the diameter to the center of the rollers) is always 3.23607 times the roller diameter. For twenty rollers the pitch diameter is 6.39245 times the roller diameter. The table gives these constants, and the corresponding theoretical bearing dimensions, for any number of rollers from ten to twenty.

Neglecting clearances, the inner-race diameter is the pitch diameter *minus* one roller diameter, while the outer race diameter is the pitch diameter *plus* one roller diameter. It follows that if we select a certain diameter of drill rod for the rolls and choose a certain number of rollers, we automatically fix the diameters of the inside and outside races.

The next step is to look through the table to find a combination of number of rollers and roller diameter that will give suitable race diameters. Then machine the races to these figures with slight corrections for clearances.

Note that the table does not allow any clearances. The nature of the clear-

Race and Pitch Diameters for Indicated Roller Diameters

(No Clearances Included)

No. of Rollers	Constant		1/8"	3/16"	1/4"	3/8"	1/2"
10	3.23607	OUTER	0.5295	0.7943	1.0590	1.5885	2.1180
		PITCH	0.4045	0.6068	0.8090	1.2135	1.6180
		INNER	0.2795	0.4193	0.5590	0.8385	1.1180
11	3.54953	OUTER	0.5687	0.8530	1.1374	1.7061	2.2748
		PITCH	0.4437	0.6655	0.8874	1.3311	1.7748
		INNER	0.3187	0.4780	0.6374	0.9561	1.2748
12	3.86370	OUTER	0.6080	0.9119	1.2159	1.8239	2.4318
		PITCH	0.4830	0.7244	0.9659	1.4489	1.9318
		INNER	0.3580	0.5369	0.7159	1.0739	1.4318
13	4.17873	OUTER	0.6473	0.9710	1.2947	1.9420	2.5894
		PITCH	0.5223	0.7835	1.0447	1.5670	2.0894
		INNER	0.3973	0.5960	0.7947	1.1920	1.5894
14	4.49413	OUTER	0.6868	1.0301	1.3735	2.0603	2.7471
		PITCH	0.5618	0.8426	1.1235	1.6853	2.2471
		INNER	0.4368	0.6551	0.8735	1.3103	1.7471
15	4.80973	OUTER	0.7262	1.0893	1.4524	2.1786	2.9049
		PITCH	0.6012	0.9018	1.2024	1.8036	2.4049
		INNER	0.4762	0.7143	0.9524	1.4286	1.9049
16	5.12583	OUTER	0.7652	1.1486	1.5315	2.2972	3.0629
		PITCH	0.6407	0.9611	1.2815	1.9222	2.5629
		INNER	0.5157	0.7736	1.0315	1.5472	2.0629
17	5.44214	OUTER	0.8053	1.2079	1.6105	2.4158	3.2211
		PITCH	0.6803	1.0204	1.3605	2.0408	2.7211
		INNER	0.6553	0.8329	1.1105	1.6658	2.2211
18	5.75877	OUTER	0.8484	1.2673	1.6897	2.5345	3.3794
		PITCH	0.7198	1.0798	1.4397	2.1595	2.8794
		INNER	0.5948	0.8923	1.1897	1.7845	2.3794
19	6.07576	OUTER	0.8845	1.3267	1.7689	2.6534	3.5379
		PITCH	0.7595	1.1392	1.5189	2.2784	3.0379
		INNER	0.6345	0.9517	1.2689	1.9034	2.5379
20	6.39245	OUTER	0.9241	1.3861	1.8481	2.7721	3.6962
		PITCH	0.7991	1.1986	1.5981	2.3971	3.1962
		INNER	0.6741	1.0111	1.3481	2.0221	2.6962

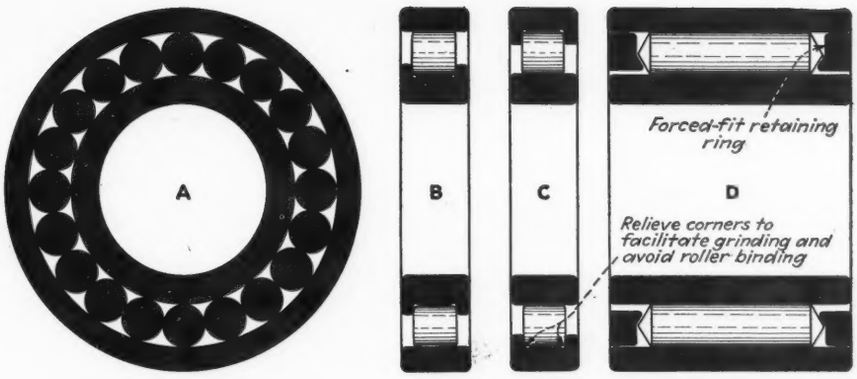


Fig. 2—Cut rollers from drill rod. Turn ends only, then harden and temper. Turn races from soft steel. If possible, case-harden the races and grind to correct size

ances in this case is easily understood, although the amount to be allowed requires judgment. If the diameter of any circle is increased by a certain amount the circumference is increased 3.1416 times that amount. In Fig. 1, imagine the outer race removed, the rollers being held against the inner race by rubber bands only. Next imagine the inner race diameter increased by 0.001. That will increase the diameter of the pitch circle by 0.001 and its circumference by 0.003, giving an average clearance between rollers of about 0.0003 in the case of a bearing with ten rollers.

In general, the circumferential clearance will be satisfactory if the diameter of the inner race is increased over the theoretical figure in the table by approximately 0.002 or 0.003 in. per inch of pitch diameter.

To get the diameter of the outer race add the actual (enlarged) diameter of the inner race to twice the roller diameter, and to this add a *diametral* clearance. For a tight bearing with ground races a diametral clearance of about 0.001 in. per inch of pitch diameter should be about right. It may be necessary to double this for bearings of rougher construction.

Problem Worked Out

The method of procedure is best understood if we take an actual problem. Assume the shaft diameter is 1 in. and opening in housing is 2½ in. In the table find a combination of roller diameter and number of rollers that would give a practicable bearing. For sixteen ⅜-in. rollers, the table gives an inner race diameter of 1.5472 in. leaving over ¼ in. metal thickness in the race, which should be ample. On the outside it gives a race diameter of 2.2972 in. This allows about 0.35 in. metal thickness inside of the outer housing.

Next the listed inner and outer race diameters must be adjusted slightly for clearance. First, let's add about four-thousandths of an inch to the inner race diameter to give 1.5510 in. This will give about 0.012 in. total play of the rollers around the circumference. The theoretical outer race diameter would then be 1.5510 in., plus three-quarters of an inch, or 2.301 in. If we allow a diametral clearance of another 0.003 in., this gives an outer race diameter of 2.304 in.

Machining Suggestions

Any reader interested can look up "correct" bearing loadings in handbooks, but they will not be of great value for these home-made bearings. We shall assume that this bearing is strictly for emergency use and that the mechanic concerned has enough common sense to guess or "feel" whether the bearing will take the punishment to which it will be subjected. If he makes his rollers from drill rod the outside rod surface need not be touched, but the roller ends must be neatly squared or rounded, and the rollers hardened by heating to cherry red heat and dipping in water or oil. Next step is to temper the rolls to a point somewhere between straw and blue.

Since, in general, the races must be turned from soft machine steel, case hardening by cyanide or other process (ask your blacksmith) will be desirable, although a soft bearing may serve for a while where loads and speeds are moderate. For a first-class job, both races may be ground (after hardening) using a lathe and tool-post grinder. Where grinding is impractical, a reasonably true and smooth surface can be produced by turning, followed by light filing and fine emery cloth.

Care should be taken to get the surface as smooth and true as possible with the turning tool before finishing off with file and emery cloth.

For some purposes a very short roller bearing like those shown at *B* and *C* (Fig. 2) will suffice. *B* shows the flange on the outside of the inside race, and *C* on the outside race. The indicated grooving at edges of the races, and beveling of the rollers, insure contact on the proper rolling surfaces exclusively.

The method shown in *D* for retaining the rolls is common in what is called a "needle bearing," a bearing made up with a large number of long slender rollers. Here the roller ends may be pointed or convexed and held loosely by shroud rings like those shown, pressed in.

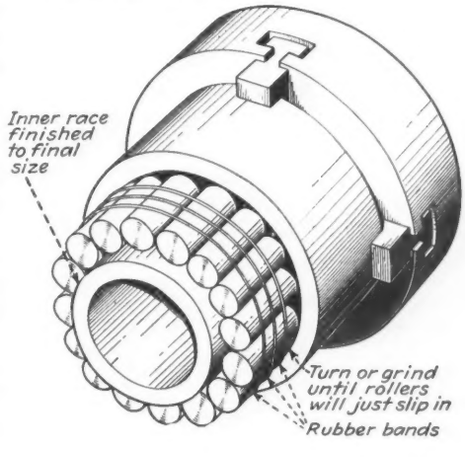
"Cut and Try" Measurement

Where the mechanic doing the work does not have suitable internal and external micrometers he may proceed as follows by "cut and try." First select and prepare the right number of rollers of the right diameter. Second, turn the outside diameter of the inner race somewhat larger than the dimension shown in the table. Harden the inner race and grind it down until the rollers can be clamped on the outside of the inner race with a rubber band and leave slight clearance (not too much) between them.

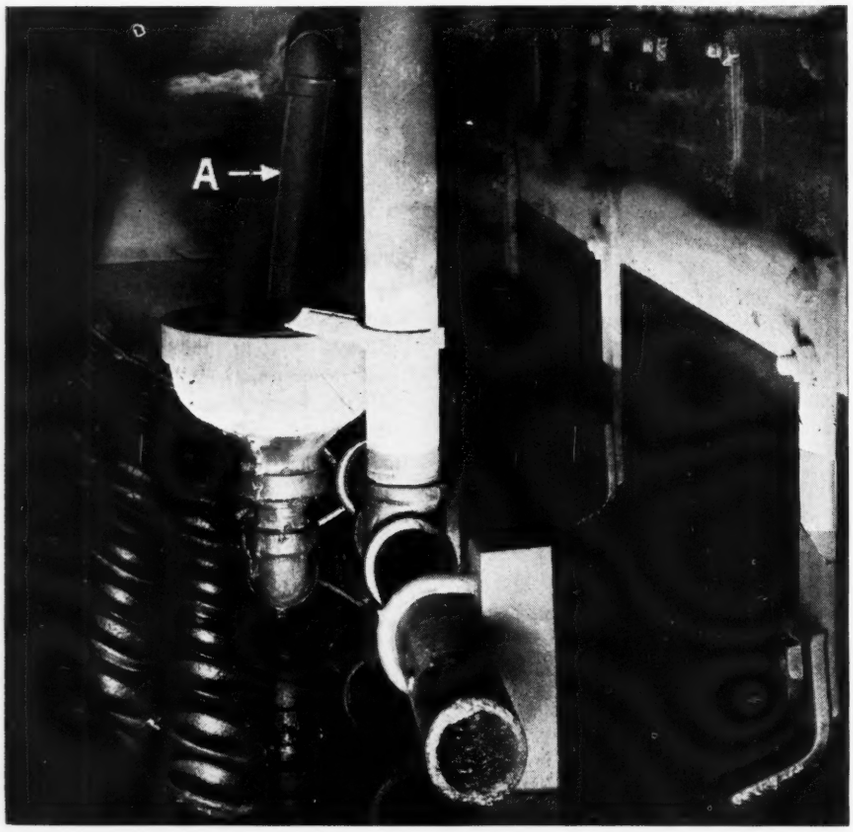
Third, turn the inside of the outer race to a diameter several thousandths smaller than that shown in the table. Harden; then continuously grind it larger, testing now and then for size with the rollers in position on the inner race. For easy handling clamp the rollers to the inner race with several rubber bands as shown in Fig. 3, take small test cuts on the edge of the outer race until the rollers will just slip in, then grind across the face, removing about 0.0005 in. at a time until rollers are just loose enough for easy running.

(See page 91 for discussion of emergency journal bearings.—Editor).

Fig. 3—To avoid precise calculations and measurements, outer races may be ground to size by "cut and try" (see page 91). Rubber bands will hold rollers while testing outer race diameter



PRACTICAL AIDS TO OPERATION



Surface Blowdown Keeps Oil from Boilers

AFTER TRYING ABOUT EVERY METHOD of keeping oil out of our boilers we decided to install a surface blowdown in the drums, as in the photo. Its intake consists of a 12- to 2-in. pipe reducer, bushed on the 2-in. end for 1½-in. pipe. We drilled and tapped one of the drum heads in each boiler for a 1½ in. nipple to make the inside and outside connections to the blowdown piping.

Inside the drum the blowdown is securely anchored to the feedwater pipe and supported from the bottom of the drum. The blowdown pipe rises and goes out through the drum head as at *A*. Discharge from the surface blowdown goes into the blowdown tank.

Top of the blowdown intake is set about 2 in. below normal boiler water level. Before blowing down, we raise the water level about 1 in. above normal and continue blowing until we hear steam. Normally the boilers are blown down once a day, using the surface blowdown and the mud-drum connections on alternate days.

Since we put in the surface blowdowns, no sign of oil has shown in the gage glasses, where it was quite evident in previous years. Periodic tests are made on boiler-water samples, none of which have shown any indications of oil being present.

New York, N. Y. P E MEREDITH

Paraffin Sealing Saves Maintenance Materials

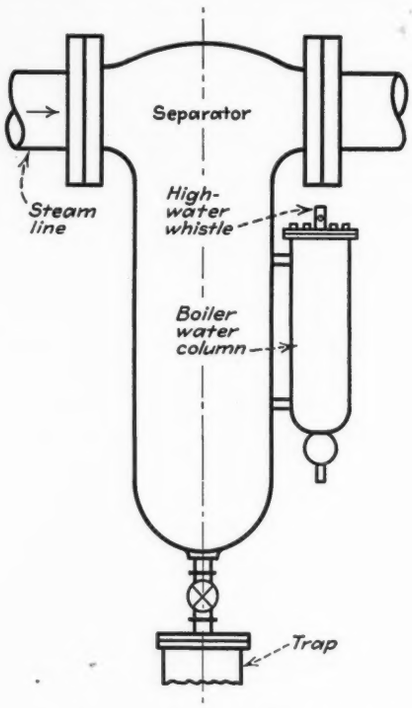
NUMEROUS MATERIALS REQUIRED in plant maintenance deteriorate rapidly unless kept in air-tight containers. Typical of these are paints, pipe-thread compounds, boiler-setting cements and similar items. Although the various materials exhibiting this tendency toward deterioration are ordinarily supplied in hermetically sealed cans it is often quite difficult to re-seal many kinds of these containers once they have been opened. Consequently losses occur quite frequently when unused portions of the contents of the freshly opened containers must be kept for some length of time.

If it is impossible to re-seal such containers tightly, melted paraffin can often be used to prevent air reaching the material. The paraffin is melted and poured directly on top of the left-over material in the container. After hardening, the paraffin forms an air-tight seal. It can be removed by heating the can until the paraffin melts around the edges and becomes loose enough to be lifted out in the form of a disk.

Richmond, Va. C R ANDERSON

High-Water Alarm for Steam Separators

A SEPARATOR FOR SUPPLYING dry steam to a steam engine or other equipment must be properly drained. A trap is the customary method of doing this but if it fails the separator will become flooded and water may be carried over into the equipment to be protected. To prevent a separator being flooded the engineer installed a standard boiler water column with a high-water alarm whistle on it, as in the figure. These columns are usually equipped with both a high- and a low-water alarm whistle.

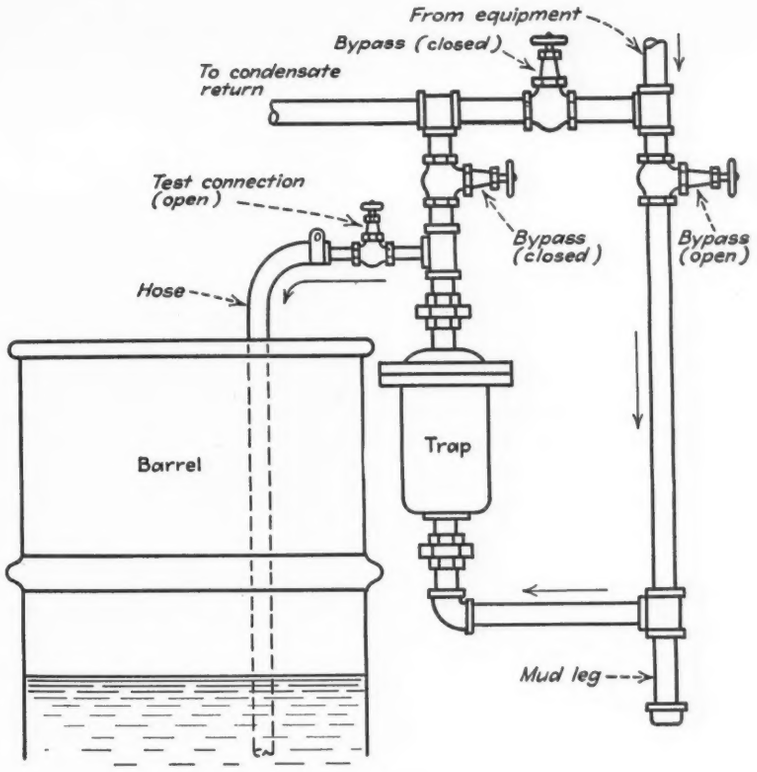


Therefore, it is necessary to block or remove the mechanism for the low-water whistle. As with all automatic alarm devices, the operator should not rely entirely on the whistle and neglect periodic inspection of the trap and separator.

Chicago, Ill. R O Billings

Recommends Test Valves in Trap Discharge Lines

Some engineers when installing traps will habitually provide test valves in the discharge lines, so that trap condition may be determined at regular intervals. These attachments are particularly handy in noisy locations and when apparatus is operated in battery with individual traps. Considering the small additional cost for a valve, tee and a couple of nipples the testers are well justified. They recently helped determine the steam consumption of some new equipment without disturbing a lot of piping that otherwise would have been necessary.



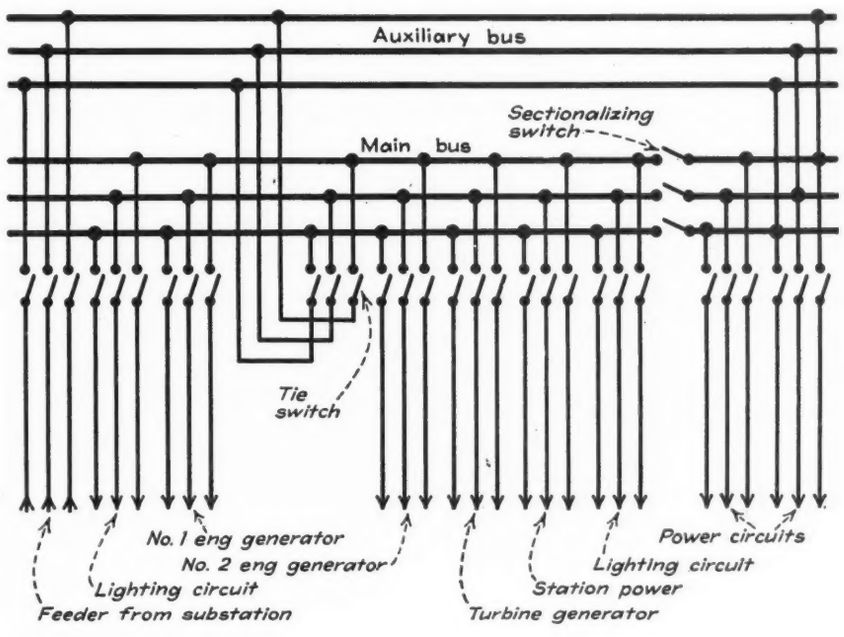
As shown in the diagram, the trap was allowed to discharge through the test connection and hose into a barrel containing a known weight of water. The increase in amount of water represented the steam consumption of the apparatus during the operating period.

In addition to obtaining cost figures easily, the arrangement also makes it easy to stop the usual reckless bets and fantastic estimates of the boiler-room banshees and plant prophets when new equipment is installed, and will also quiet the fireman's squawk about his slice-bar and shovel work since that so-and-so such-and-such was installed.

Melrose, Mass. Elliott MacDermod

Insured Lighting Power by Station Busbar Changes

In an old power plant in which one turbine- and two engine-driven units were installed, only the turbine-generator was operated. This unit was loaded so that it supplied the necessary low-pressure steam for the heating mains, balance of the load being supplied from a substation connected to the transmission system and power-station bus. If trouble occurred on the transmission system, the turbine could not supply the total local load and low voltage and frequency or a complete blackout might result.



To prevent this happening we installed an auxiliary bus and connected the feeder from the substation to it, as in the diagram. We cut the main bus between the power circuits and the rest of the station circuits and installed a sectionalizing switch, so that the power load could be put on the substation only if necessary. The tie switch was one formerly used on a generator that had been removed from the station, so that all we had to do was connect it to the auxiliary bus.

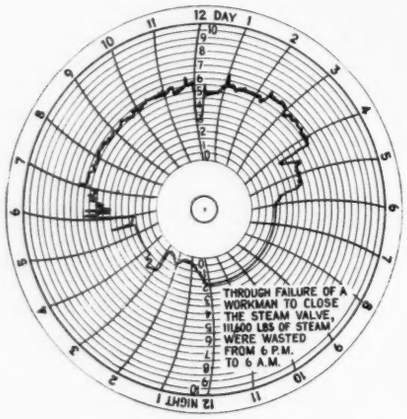
Now, during normal operation the station is synchronized with the transmission system and the tie switch closed, with the sectionalizing switch left open at all times. When trouble occurs on the transmission system the tie switch

opens, disconnecting the power circuits from the station, which then has to supply the lighting load only. This leaves the power circuit to be supplied from the transmission system. When the trouble clears, the station is again synchronized with the auxiliary bus.

Duluth, Minn. E R WEBBER

Flowmeter Record Reveals Steam Waste

THIS CHART IS THE 24-HR RECORD of steam consumption in the hog-killing department of a Chicago plant. It is interesting because it shows a consumption of steam from 6 p.m. to 6 a.m.,



when the department should not have used any steam. Investigation disclosed that steam had been permitted to leak into the hot-water heaters all night, some one having neglected to close the steam valve tightly. This resulted in the loss of 111,600 lb of steam, which cost $33.00.

Philadelphia, Pa.

S D DISTELHORST
Cochrane Corp

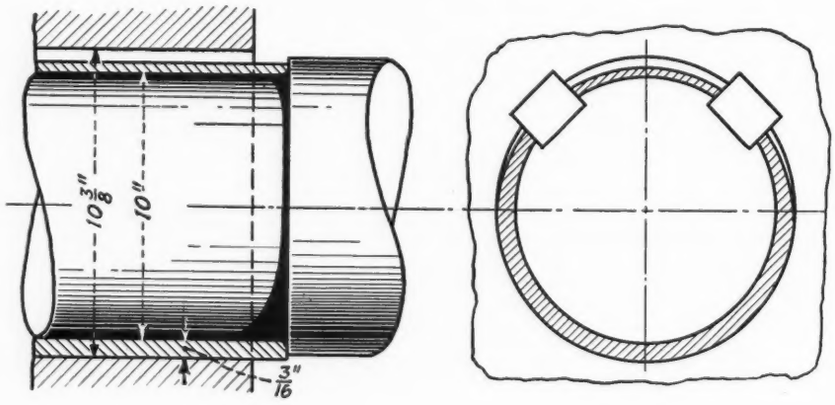
Loose Flywheel Keyed Tightly to Shaft

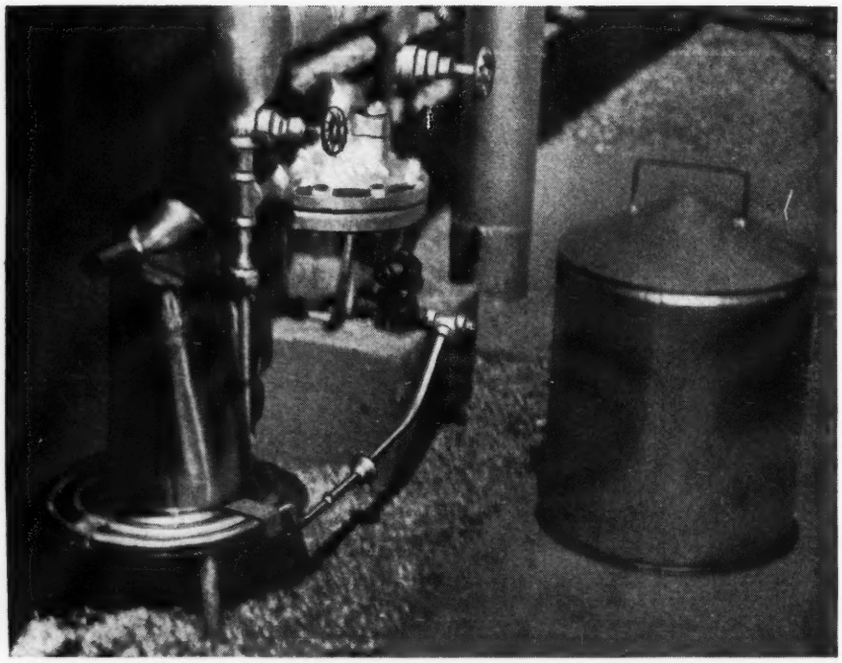
KEYS IN THE FLYWHEEL of a rolling-mill engine gave trouble by working loose. As the mill rolled short thin hard sheet the flywheel and its keys were subjected to heavy and frequent shock loads. When the job became my responsibility I decided to do something to end the nuisance.

The flywheel made a loose fit on the shaft and had evidently been bored that way so that it could be positioned easily. As a result keys worked loose and were tightened with shims from time to time. These shims broke and worked in between the flywheel bore and shaft and prevented our getting the wheel off. This obstacle was cleared by removing the keys and working the flywheel around on the shaft by starting and stopping the engine until the shims came out in small pieces in the keyways.

The flywheel bore was found $\frac{1}{16}$ in. larger than the shaft and badly scored. To put the shaft in good condition it was turned down $\frac{1}{4}$ in. under size, making it $\frac{3}{8}$-in. smaller than the flywheel bore. We then forged a steel bushing and turned its inside diameter 0.005 in. undersize and its outside diameter to a fit that required a jack to force it into the flywheel bore.

The bushing was then taken out and put off center in the lathe so that one half of its thickness could be turned



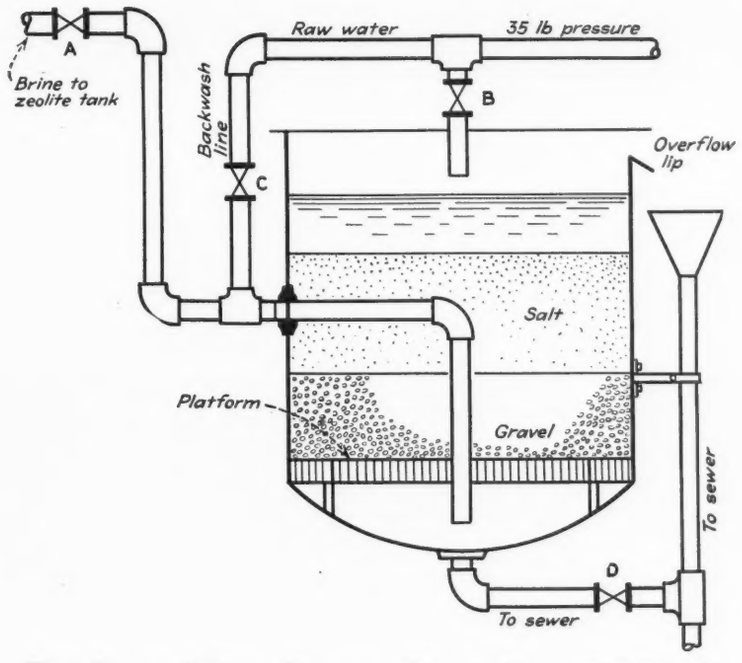


Hot-Plate Heater for Lubricating Oil

WHEN POWER-PLANT EQUIPMENT is exposed to low temperatures it may be necessary to heat the lubricating oil to keep it at proper viscosity. In one plant, as shown in the photo, a base for the heater was made from light iron by welding. The heater consists of a flat coil of $\frac{1}{4}$-in. copper pipe connected to the drain connection on a trap. At the discharge end of the heating coil a needle valve regulates flow through the coil to that required to keep the oil at the correct temperature for use in the bearings.

Oil is heated in a one-gallon measure on the heater. To conserve heat and insure even heating, a cover to fit over the oil container was made by cutting the bottom from a 5-gal round can and soldering a conical top on it, as shown at the right.

Santa Monica, Calif. J C ALBRIGHT



Backwashing Saves Gravel and Work

THE OTHER DAY AN ENGINEER FRIEND visited my power plant and while showing him about, I mentioned backwashing the salt tank on our zeolite water-softening system. He told me that for years in his plant they had been shoveling the gravel and salt residue out of their salt tank and then after replacing the platform, put in new gravel to support the salt charge.

If any other engineers are doing the same, they can save themselves a lot of work by hooking their salt tank like mine, shown in the diagram. In this system there is no brine tank between the salt tank shown in the diagram and the zeolite tank. Brine is taken directly from the salt tank to the zeolite tank by an injector.

In normal operation, valves *B*, *C* and *D* are closed. When the zeolite is being charged, valve *C* is opened and the brine drawn from the salt tank by an ejector. Water level in the salt tank is maintained by opening valve *B* above the tank.

When all the salt is dissolved from the tank a heavy residue is left in the gravel. We then open valve *C*, leave the other valves closed and force water up through the gravel bed to the sewer for about 15 min. This cleans the gravel thoroughly, after which we close valve *C* and open valve *D* to drain all water from the tank. Any remaining residue is left on top of the gravel where it can be taken out without removing the gravel. We then put in a new charge of salt and fill the tank with fresh water and are ready for water softening.

Farmington, Mo. P J GORDON

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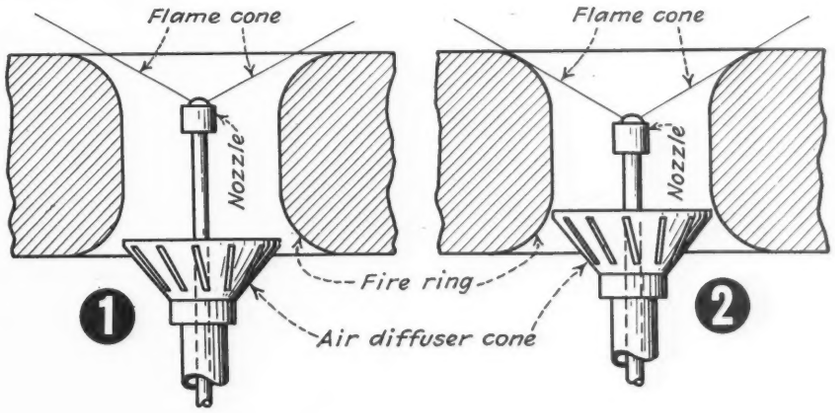
off without going below the bushing diameter. This left the unturned half of the bushing a tight fit in the flywheel bore. The old keyways were cut wider than normal and new keys fitted, the bushing cut to fit tightly between the keys and then pegged to the shaft. The top clearance allowed the shaft to be put into place easily and when the keys were driven tightly the equivalent of a press fit was obtained on the thick half of the bushing opposite the keys. For several years we had no further trouble with the flywheel coming loose.

Brighouse, England F L BERRY



Changes in Oil Burners Increase CO_2

ON OUR OIL-FIRED BOILERS we found it difficult to raise the CO_2 above 10%. With tight settings and sufficient oil pressure it should have been necessary only to reduce the excess air to raise the CO_2. The burners are mechanical atomizing with natural-draft registers, and any attempt to raise the CO_2 above 10% by reducing the draft with the stack damper caused the fires to pulsate.

A study indicated that the burner nozzles extended too far into the furnace; the oil spray cone cleared the fire ring by about 2 in., Fig. 1. Under such a condition air could pass around the cone instead of through it. We shortened the burner stem so that the nozzle could be positioned to bring the oil-spray cone almost in contact with the fire ring, Fig. 2, but this did not improve the CO_2.

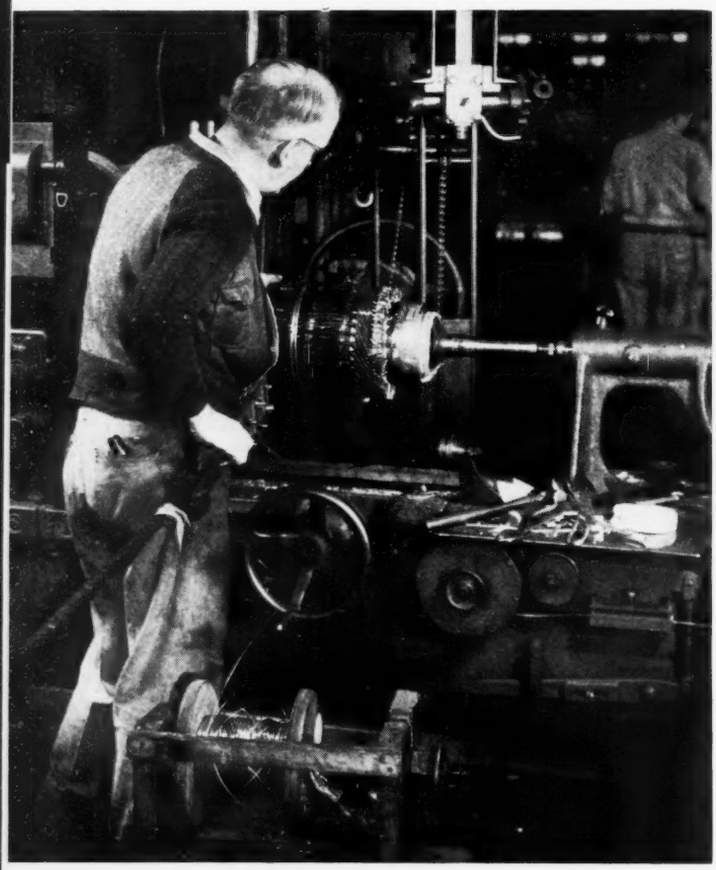
Next we experimented with the register openings, without result. This led to a decision to control the draft in the fire ring, but the air diffuser cone as originally installed could not be moved into this ring, Fig. 1. We removed the old jacket tube that supported the diffuser ring and installed a new one 2½-in. longer. This permitted moving the diffuser cone into the fire ring, Fig. 2. When this was done the CO_2 jumped up to 12%. We can now easily obtain 14% CO_2 but operate at between 12 and 13%. Setting the air-diffuser cone nearer the fire ring caused more air to go through the slots in the diffuser at high velocity, increasing its turbulence and causing better mixing with the fuel.

New York, N. Y. P E MERIDETH

HOW TO BAND AN ARMATURE

Pictures posed by POWER's photographer in the Newark, N. J. mfg. and repair department of the Westinghouse Electric & Mfg. Co.

ARMATURES ARE BANDED, not only to keep the coils from being thrown out, but to hold them snugly in place. A loose band will keep the coil within its slot, but coil movement causes chafing of the insulation. Constant coil movement will eventually cause insulation to fail. In the case of core bands, the bands themselves may be tight, but insulation shrinkage may introduce clearance between band and coil. Inserting additional fillers under the old band is unsatisfactory and the armature should be rebanded. Here is a step-by-step procedure for banding an armature. Photographs illustrate the winding of a core band. Apply coil-end bands in a similar manner.



2 Guide the banding wire in place until all but the last turn is wound. As the last turn is wound bend the binding strips back over the wire and solder firmly. Before the wire is cut make a firm solder joint to hold both ends. Solder the entire surface of the band. Use only a rosin flux for soldering banding wire. Armatures with pre-insulated coils should be heated to 167 F and banded temporarily until cool to eliminate insulation shrinkage

1 Use only high-grade steel banding wire. Rotate armature slowly, prevent reverse rotation and maintain tension on the wire until it is firmly soldered. Twist a loop in the free end of the wire and wrap with tape to form a friction grip by overlapping turns around the armature. Prepare the band insulation using the same kind that was previously removed. Insert slot fillers or band strips and tinned-copper binding strips under a temporary holding string. Locate binding strips at 90-deg positions or every 6 in., with two at banding-wire ends

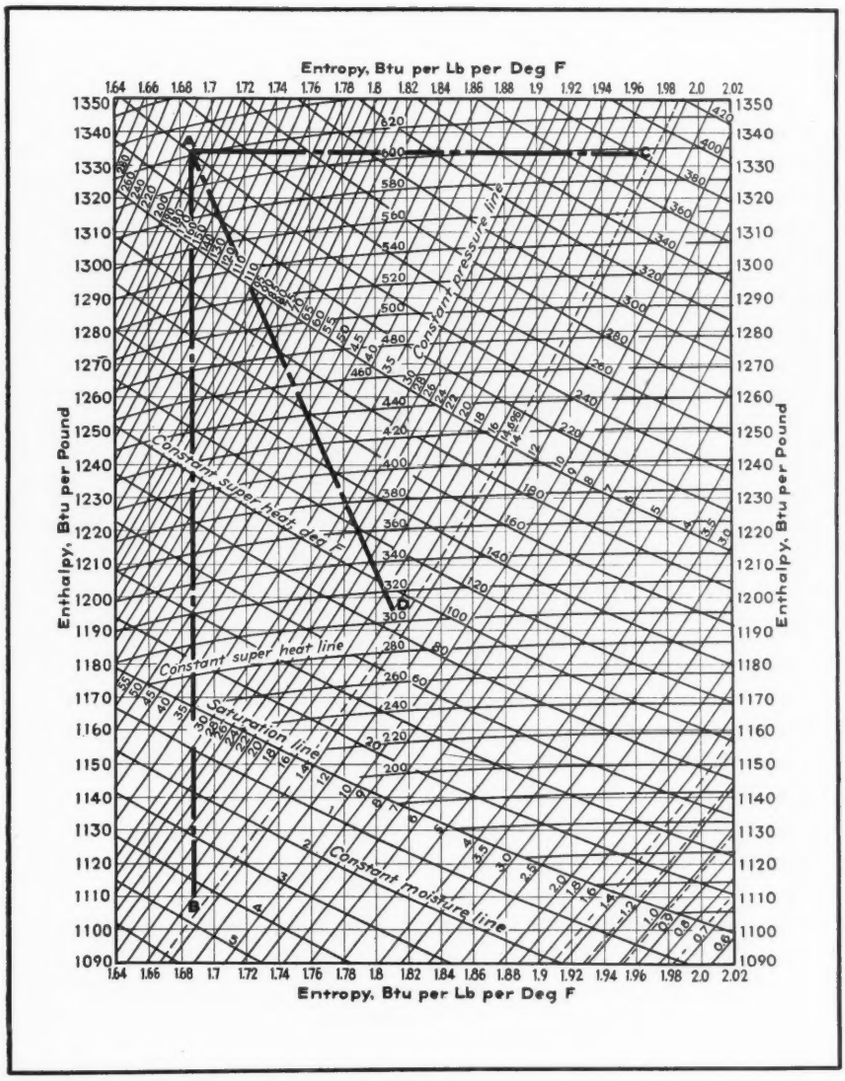
Tension on Core Bands					
Wire size	.0803	.072	.064	.057	.045
Tension, psi	400	400	300	200	200

3 Tension clamp is constructed from heavy fiber with tongue and groove fitting. Friction is adjusted by wing nuts. Correct tension is applied by a rope running from the clamp over a pulley to a suspended weight. Suspended weight equals tension on the wire and depends on wire size. Wire size is governed by clearance between armature and pole pieces

Steam Table Drills—No. 6

How to Use the Mollier Chart

By PHIL SWAIN


Entropy, Btu per Lb per Deg F
Enthalpy, Btu per Pound
Constant pressure line
Constant super heat deg F
Constant super heat line
Saturation line
Constant moisture line

Section of Mollier chart, by permission, (some lines omitted) from Keenan and Keyes *Thermodynamic Properties of Steam*, published by John Wiley and Sons.

IN A POCKET in the back of the Keenan and Keyes steam tables is a chart nearly 3x4 ft. This most modern form of the well-known Mollier chart is nothing more or less than a graphic steam table covering pressures all the way from 0.2 to 5400 psi and steam qualities from deep in the wet-steam region up to superheated steam of 1200 F total temperature.

The gridwork lines of the chart represent enthalpy and entropy. Vertical lines are constant entropy and horizontal lines are constant enthalpy. Therefore, for any point on this chart you can read at once the enthalpy, the entropy, the steam pressure, and either the moisture in the steam on one hand or superheat and total temperature on the other.

If any two of these properties are known they give an intersection and thereby determine a point from which the other properties can be read directly. This operation is perfectly simple although the confusion of lines on the chart makes it look hard.

The chart on this page, redrawn from a small section of the Keenan and Keyes Mollier chart, is not intended for practical use, but merely to show how to use the original.

Point *A* at the intersection of the lines for 200 psi abs and 620 F total temperature, represents steam at that condition. Note that the line for 240 F superheat goes through this point, so that is the superheat corresponding to 620 F at 200 psi abs. This figure can be more exactly determined from the steam tables as 238 F.

Reading horizontally, we see that the enthalpy is 1333 Btu per lb. Reading vertically, we find the entropy, 1.686 Btu per lb per deg F.

Expansion of Steam

The Mollier chart can be used to show the results of various types of expansion of steam. For example, expansion in a "perfect" engine or turbine is without change of entropy and must therefore be represented by a vertical line. Thus line *AB* represents expansion without change of entropy to 16 psi abs. Note that the exhaust steam contains 4.3% moisture and has an enthalpy of 1110 Btu per lb.

Enthalpy drop during expansion is 1333 − 1110 = 223 Btu, so the "perfect" turbine would have a steam rate of 3413 ÷ 223 = 15.3 lb per kwhr.

When steam is throttled through a reducing valve the enthalpy remains constant, so the line *AC* represents throttling to 16 psi abs. Note here the final temperature of the steam is 596 F and the corresponding superheat 380 F. Throttling increases superheat or quality.

The expansion of steam in an actual turbine always falls between that in a perfect turbine on the one hand and in a reducing valve on the other. Its expansion might be represented by a line such as *AD*. Thus the common statement that a turbine exhausting to process acts as a "reducing valve" is not strictly true because the turbine exhaust is at lower quality than that of a reducing valve.

READERS' PROBLEMS

Questions from Our Readers

Boiler-Feed-Pump Troubles

Question 1

IN OUR BOILER PLANT *we supply feedwater to an open heater from a 20-ft well with a steam-driven reciprocating pump. Water is heated with engine exhaust steam at 5 psi. The cold-water pump is inside the boiler room, about 40 ft from the heater. The steam-driven reciprocating boiler-feed pump beside the heater in the engine room has a positive suction head depending on the height of water in the heater. The boilers are not equipped with water-level control and each pump must be regulated by manual adjustment of its steam supply.*

We have considerable trouble in keeping the pumps regulated to handle the same amount of water. Slowing down the well pump causes it to lose prime. The heater then becomes empty, the feed pump loses prime and becomes steam bound. On the other hand, reducing the speed of the boiler feed pump allows the heater to become flooded. Can any of POWER's *readers suggest some means of overcoming this trouble?*—HRT

Rolling Boiler Tubes

Question 2

What are the opinions of POWER *readers concerning tube rolling in boiler drums, headers, and economizers? Should tube-expander rollers have half the taper of the pin on all sizes of tubes or only on 2-in. and smaller tubes? Are 4-in. circulating tubes rolled with straight expanding rollers and a tapered pin? We would like to read discussions from other power-plant operators on the methods they have found most successful for different tube sizes*—RNL

Failure of Magnetic Separator

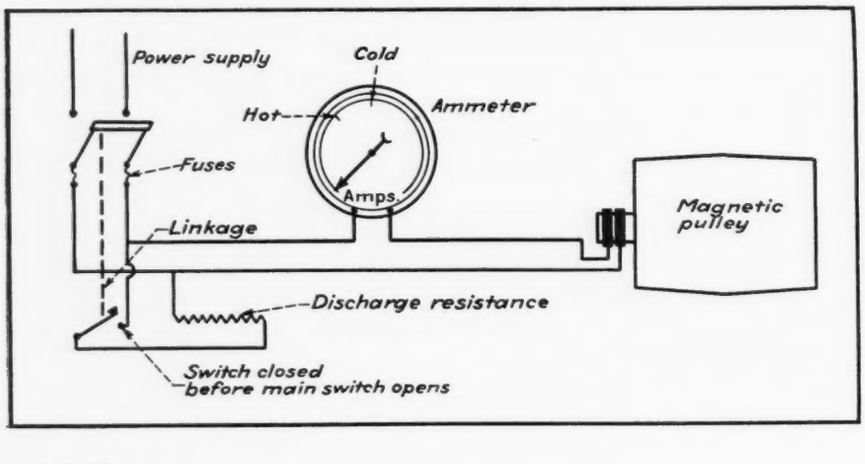
Answers to April Question 1

The Question

WE HAVE A PROBLEM *for which we have as yet found no solution. We recently rewound a magnetic separator pulley which was originally wound with No. 9 round enamel magnet wire for 125-volt dc service. Lack of a spare required restoring this pulley to service. Not having this size wire in stock we substituted No. 10 square double-cotton-covered, varnishing each layer with clear varnish and placing .005-in.-thick untreated paper between layers. After winding, the pulley was baked and filled with compound. It was then returned to service and after two weeks again burned out.*

We stripped this winding and found practically every layer shorted to the adjacent layer, near the end turns, with small pin holes burned in the insulation of the wire itself and through the paper between layers.

We rewound the pulley using No. 10 round single-cotton-covered enamel wire, omitting the paper between layers. It has been returned to service. We are anxious to learn the cause of this failure and a way to prevent its recurrence. The pulley is supplied by a flexible cord and plug connecting to the feed switch.—HDJ



Cause May Be High Internal Temperatures

THE BREAKDOWN OF PULLEY INSULATION in HDJ's question was probably started by overheating. Ventilation of such pulleys is usually inadequate and internal temperatures are difficult to determine accurately. Surface temperatures are usually 75% of normal internal temperatures. The resistance method of temperature measurement is recommended, using an indicating ammeter and voltmeter. The values obtained will be sufficiently accurate for all practical purposes. The resistance method requires the cold temperature (t_1), the cold resistance $R_1 = \frac{\text{voltage}}{\text{cold current (I)}}$ at t_1, and the hot resistance $R_2 = \frac{\text{voltage}}{\text{hot current } (I_2)}$ at t_2. The unknown temperature can be determined from the formula

$$t_2 = \left[\frac{R_2}{R_1}(234.5 + t_1)\right] - 234.5$$

with all temperatures in degrees Centigrade and resistances in ohms. If voltage is reasonably constant an indicating ammeter can be calibrated with a temperature scale which will show when dangerous conditions exist. Values thus determined are average copper temperatures and will be about 10 C below actual hot-spot copper temperatures. The maximum hot-spot temperature allowable for class A insulation is 105 C, or 95 C by resistance measurement. This would correspond to a maximum surface temperature of about 71 C. If the normal operating temperature of HDJ's pulley is above this value he can operate the pulley intermittently, improve ventilation or rewind with class B insulating materials.

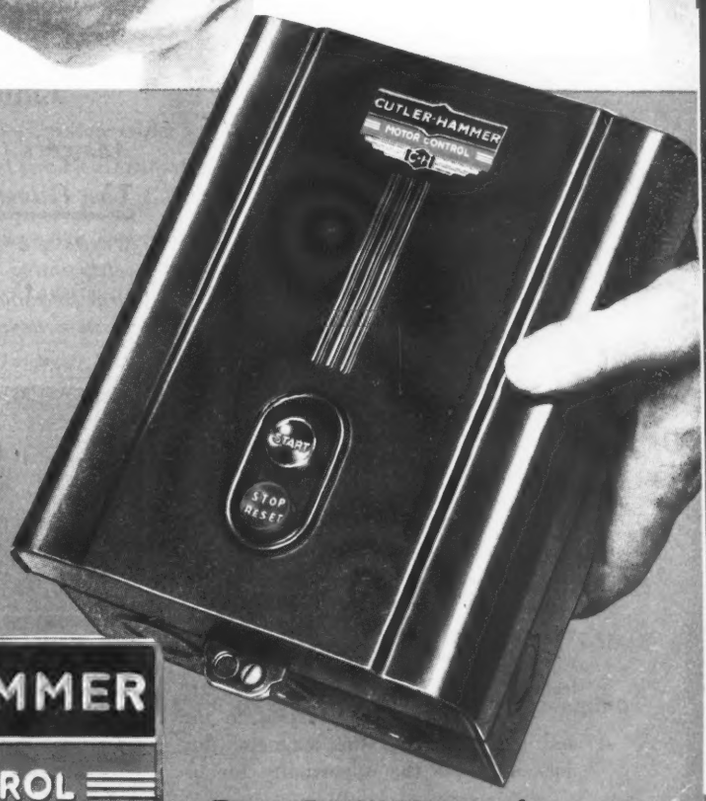
The materials recommended are asbestos-covered enamel wire with asbestos tape between each layer. Before and after each tape layer is applied, the coil should be painted heavily with a high-grade insulating varnish. The tape should be applied while the varnish is tacky. When wound in this manner the pulley winding will safely with-

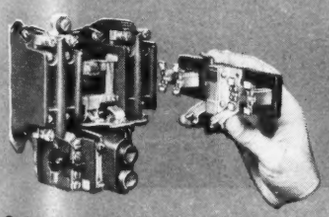
(*Continued on page* 120)

MISTER, we keep 'em *Clean!*

Keeping things shipshape is an unending job in the navy . . . for dust settles on horizontal surfaces everywhere whether these surfaces are parts of a boat far at sea or parts inside motor control in any factory.

Because dust *is* found in even the most unexpected places, it is not surprising to find it *inside* Motor Control equipment in *any* busy factory. Cutler-Hammer engineers recognized this . . . and they also knew that dusty, dirty contacts meant trouble . . . so they designed their famous VERTICAL contact Motor Control. *Vertical* contacts simply can't collect dust and dirt. They *stay* clean to work better and last longer. Such Motor Control that needs less attention and sets records for dependable performance in these days and nights of continuous high-speed production contributes not only to industrial efficiency but directly to national security. CUTLER-HAMMER, Inc., 1358 St. Paul Ave., Milwaukee, Wisconsin. *Associate*: Canadian Cutler-Hammer, Ltd., Toronto.





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1892-1942 50th ANNIVERSARY

Dust Safe VERTICAL *Contacts*

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 (Continued from page 118)

stand hot-spot copper temperatures of 125 C, or 115 C as measured by the resistance method, corresponding to maximum surface temperatures of 86 C. The pulley should not be operated if the hot insulation resistance is less than 50,000 ohms; the preferable minimum value is 250,000 ohms.

Magnetic pulleys above 700 watts should be protected with a discharge resistance connected across the pulley terminals before the power supply is interrupted. It is good practice to use such a resistance on smaller pulleys as well, especially those that may be overheated or that have low insulation resistance. This prevents damage from induced voltages of high instantaneous values when the power circuit is broken. The best value for this discharge resistance is equal to but not greater than the hot pulley resistance, and can be made from a standard strip heater. This should be connected in the circuit automatically before the power supply is disconnected, and may be done with a standard field discharge switch or a momentary-contact, normally open switch, connected by a link to the handle of the line switch.

The diagram on page 118 shows the wiring and illustrates the ammeter method of measuring temperature.

St. John, N. B. C G Clark

Reduce The Current Before Opening Circuit

The coil of HDJ's magnetic pulley is probably failing from high induced voltage generated when the circuit is broken suddenly. The best remedy is to install a variable rheostat to cut the current gradually down to a low value before opening the circuit.

Schenectady, N. Y. L W Riggs

Control Induced Voltage By Drawing Out the Arc

The pin holes between layers at the end turns of HDJ's magnetic separator pulley indicates the breakdown is being caused by discharge from high voltage induced in the coil at the time the power is turned off. The simplest cure for his trouble would be to instruct his operators to open the knife switch slowly when they cut off the power to the pulley coil. By slowly drawing out the arc the operator decreases current in the coil gradually and the magnetic flux does not have the opportunity for inducing the high voltage which punctures the insulation. If a quick-break switch is used, it should be replaced with one which can be opened slowly. The power should not be cut off by pulling out the plug on the end of the flexible cord.

Although HDJ does not say so, his pulley may be operated continuously. In this case the trouble is undoubtedly due to interruption of power to the pulley coil either by loose connection in the wiring, by defective brushes or sliprings, or bad internal connections to the sliprings. The remedy then is to check all connections thoroughly from the source of power to the leads of the coil, including the brushes and sliprings and then to make repairs if necessary.

Pocatello, Idaho Russell Wood

Connect Resistor To Limit Voltage

The insulation punctures in HDJ's pulley are evidently caused by a voltage higher than the 125 normally used to operate the pulley. Punctures were probably caused by pulling out the attachment plug and allowing an abnormal voltage to build up in the coil by collapse of the magnetic field.

I would suggest eliminating the attachment plug and installing a short-circuiting blade and contact on the knife switch with suitable resistor, and connect so that before the switch is opened the magnetic pulley windings are shorted across the resistor. This is common practice for protecting any dc magnetic device, including the fields of ac generators and field poles of shunt-wound dc generators and motors.

Toronto, Canada J C Nutter

Dissipate Stored Power

The trouble HDJ is experiencing is caused by field discharge. The coil on this pulley is highly inductive and the current must be properly disconnected to prevent an inductive voltage of a high value rupturing the winding and insulation.

The inductive value of a coil of this type can best be likened to trying to stop a flywheel that is moving by putting a plank through the spokes; an inductive coil is similar to the flywheel and must be slowly dropped to a safe value before disconnecting. This can be accomplished by putting a resistance in parallel with the coil; the current in the coil is then dissipated in the resistance unit when the current is interrupted, and the voltage drops slowly.

A resistance tube of 70 watts, 250 ohms should be connected across the coil either permanently or by a specially designed switch, to be connected only before breaking the circuit.

Diablo Heights, Canal Zone K E Hughes

Speedy Removal of Liquid Ammonia

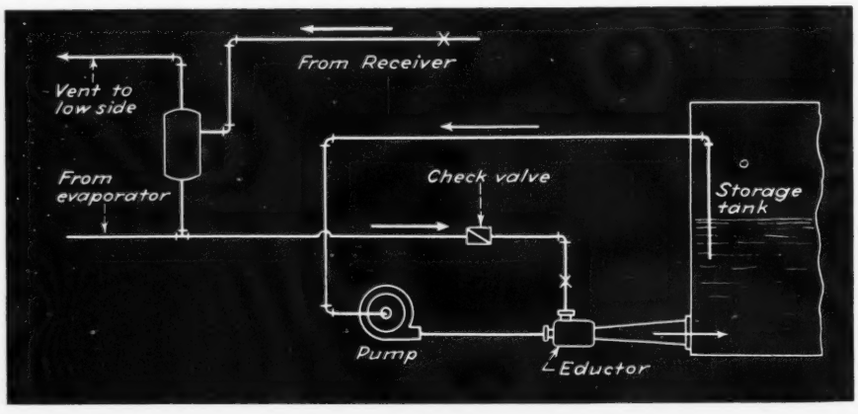
Answers to April Question 2

The Question

We have 2000 lb of ammonia *in our refrigerating system which serves a large cold-storage establishment. Coastal location exposed to possible bombing attacks together with the fact that numerous employees work in the building basements makes it imperative that we provide for quickly disposing of this liquid ammonia, or neutralizing it in case of a major leak or break in the storage system.*

We have adequate water supply from an outside source as well as a 50,000-gal basement storage tank. What method,

(Continued on page 122)



Leading Pharmaceutical Plant Finds

YARWAY TRAPS Step Up *Manufacturing Efficiency* ....

DRAINING processing kettles and other steam-heated equipment at the Hoffmann-La Roche, Inc., plant illustrated above —many Yarway Impulse Traps are contributing their share toward the most modern manufacturing efficiency.

The performance of Yarway Traps in *handling condensate from peak loads to practically nothing*—plus the fact that they are so *easily installed* and give such *trouble-free service*, have made them the choice of thousands of Trap users who have purchased more than 130,000 Yarway Traps to date.

Have you investigated this trap that *gets equipment hotter, sooner—saves fuel—saves space*—that is *easier and cheaper to install*—that *costs less to buy than to repair many other type traps?*

Ask your Mill Supply Dealer or write for Catalog T-1736.

YARNALL-WARING COMPANY, 100 Mermaid Avenue, Philadelphia

YARWAY IMPULSE STEAM TRAP

if any, could we use to mix this ammonia with water in the storage tank or mix it and then discharge it to waste? In any event it would be necessary to get rid of the ammonia in approximately ten minutes. Can POWER *readers suggest some rapid mixing method permitting safe disposal of our ammonia?*—AST

Install Drainage Header and Jet Eductor

THE 50,000-GAL storage tank appears to be ideally suited for disposing of the anhydrous ammonia in case of a bombing attack. Holding in excess of 400,000 pounds of water, the tank can easily absorb the entire charge without giving off an objectionable odor.

To overcome mixing difficulties, I suggest an arrangement as shown in the sketch on page 120. Attach a water-jet eductor to the wall of the storage tank, near the bottom, and supply the inner nozzle of the eductor by a centrifugal pump with water taken from the storage tank itself. Install a 2-in. or larger ammonia header with connection to all low points in the system, including a valved connection to the liquid receiver. The valves of the several drain connections preferably should be located near the water tank in the basement, but they may be installed at various points throughout the plant if they are plainly marked and someone is instructed at each point to open the drain valve immediately in case of an air raid. The connecting header of the several drains should be connected to the side inlet of the eductor and kept shut by a master control valve. In case of an emergency it would be necessary only to start the circulating pump, open the main shutoff valve in the ammonia line and the individual drain connections.

With this hookup, the water jet eductor will not only withdraw all of the liquid ammonia from the system in a very short time, but remove the remaining gas as well, leaving the system under a partial vacuum. The liquid receiver should be drained to the suction header by way of a flash tank which should be vented to the low side of the system. This would prevent flash gas from being trapped in the drain header and causing erratic and noisy eductor operation.

The eductor should, of course, be properly designed for this particular application. If water pressure and nozzle ratio are chosen correctly, the eductor will evacuate the refrigerating system in a very short time and without any difficulty or annoyance. Formation of ice within the eductor must be prevented by sufficient water velocity so that heat from the circulating water is supplied faster than it can be absorbed by the liquid ammonia surrounding the water nozzle, or by using a non-metallic nozzle of relatively low thermal conductivity.

The ammonia absorbed by the water can be recovered to a large extent and at very little expense if waste heat is available in the plant that could be utilized for this purpose.

Old Bridge, N. J. A J LUBELEY

Install Equipment To Flood The System

WE KNOW THAT ONE GALLON of water will absorb one pound of ammonia, and if AST works on this assumption he has sufficient water when he states that there is a 50,000-gal water tank in the basement of his refrigeration plant. It could be utilized in such a manner that his 2000-lb charge of ammonia could be discharged directly to this tank from the system, by suitable connections from either the suction or the discharge lines. The complete charge in the system could be pumped to the basement water tank.

There is also on the market a standard hydrant connection, which could be connected to flood the system in case of fire. The stop valve is equipped with a locking yoke with keys, one or more keys being kept by the local fire department, and the others by the plant engineer.

The sketch below shows the setup of an ammonia refrigeration plant. Stress has been laid on the water-line connections for flooding the system, also the position of the safety valves, which are important.

The vents of the waste pipes and safety valves should be carried to discharge at least 12 feet from windows or ventilators.

Grand Rapids, Mich. J M GORRIE

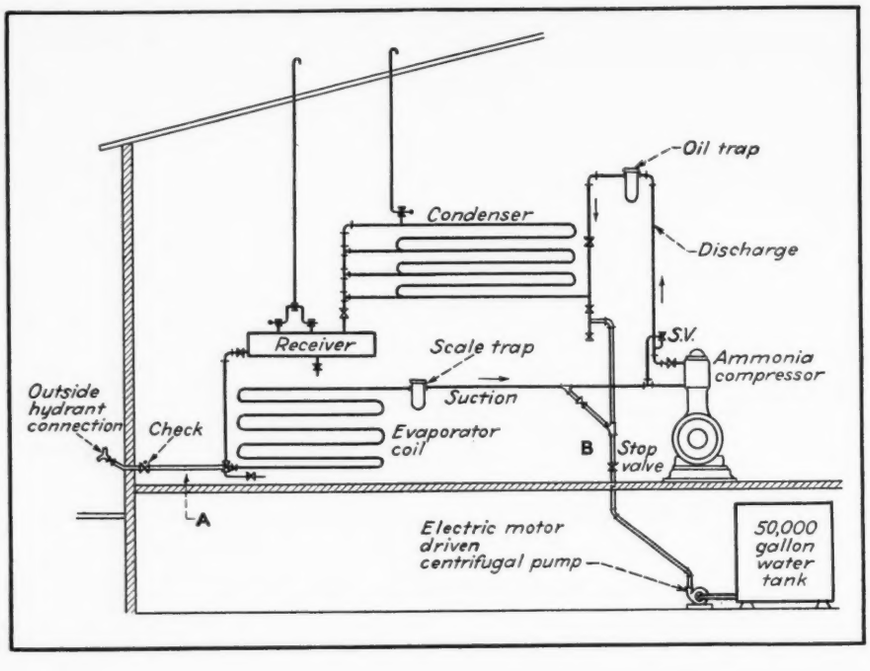
Use Milk Of Lime To Release Ammonia

IN ANSWER TO AST'S QUESTION on the removal of 2000 lb of ammonia it would require the release of ammonia gas 1000 times the volume of the water in which it is contained, or 2,000,000 lbs of water. Ammonia water contains two kinds, free and fixed ammonia. Free ammonia can be released by boiling; addition of a milk of lime solution will drive off the fixed ammonia.

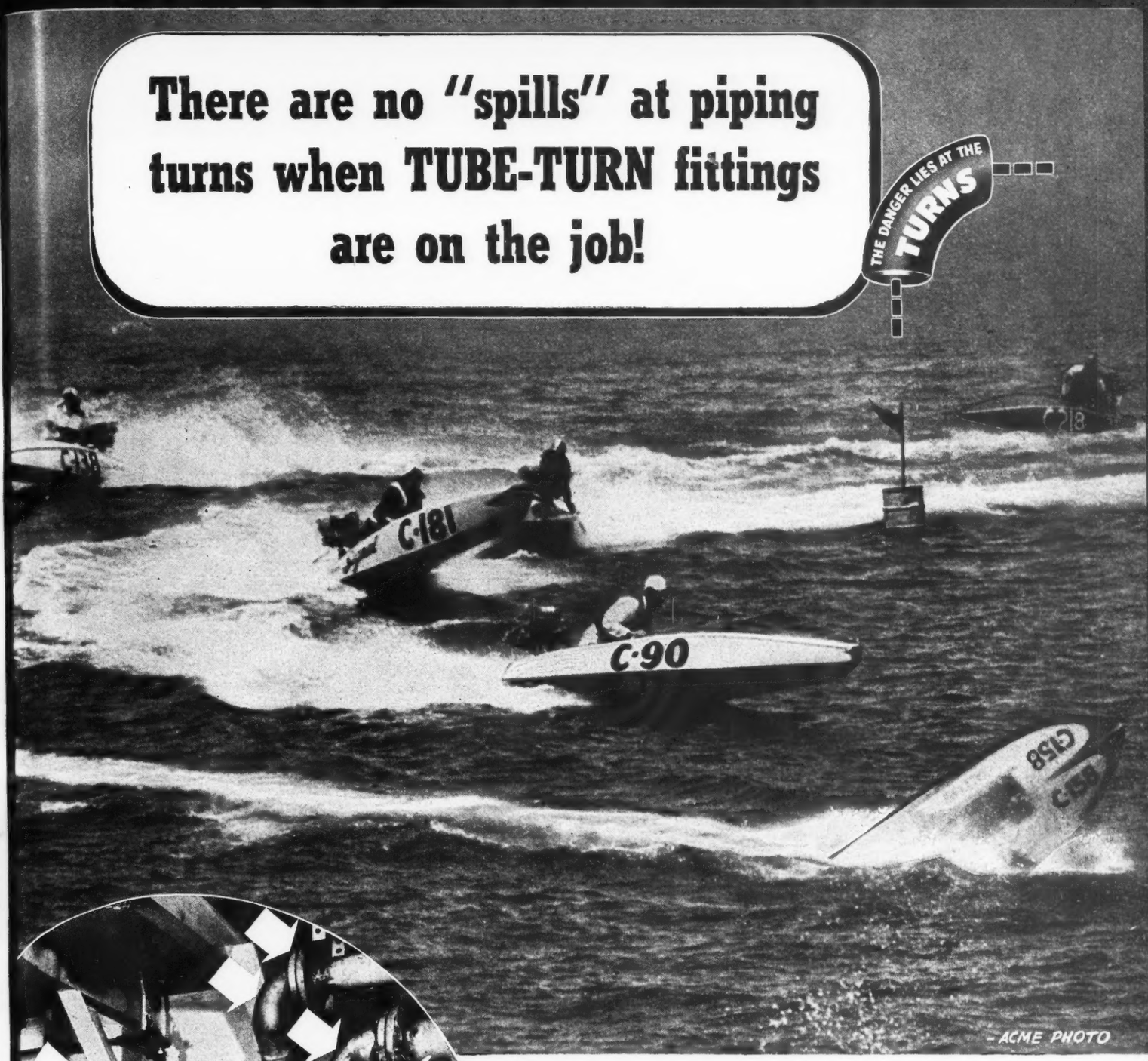
Two thousand pounds of ammonia are equal to 400 gal and 750 gal of water should be kept in the 50,000-gal tank at all times; if the occasion arises, discharge the ammonia into it. The tank should have a vent pipe to the atmosphere. A sprinkler system supplying a fine spray of water over the affected area will absorb any escaping ammonia fumes.

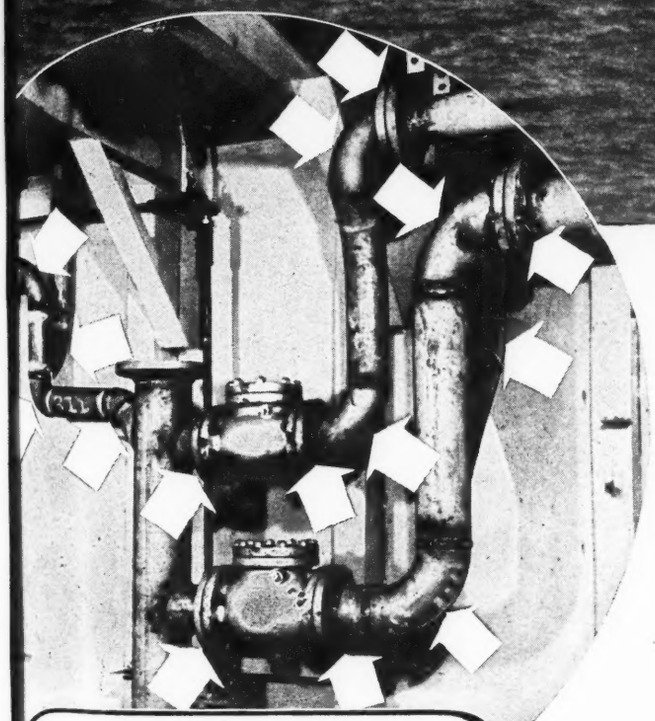
To dispose of the diluted ammonia water an ordinary ammonia still could

(*Continued on page* 124)



There are no "spills" at piping turns when TUBE-TURN fittings are on the job!





In this small area are *fifteen* places where Tube-Turn welding fittings and flanges are on the job—giving full protection against leakage and other maintenance worries. In any complete piping system, figure the hundreds of points where flow direction changes, and you'll see why Tube-Turn returns, elbows, tees, reducers, laterals, nipples, caps and flanges offer extra protection and trouble-free piping.

Disaster at the turns is an old story—

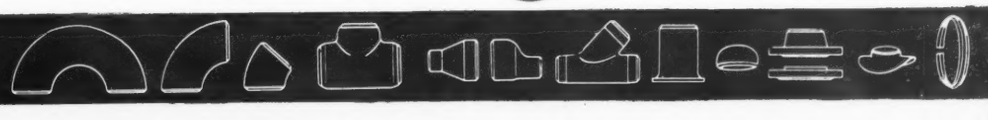
With spray flying and motors roaring, speed boats hurtle around the buoy-marked racing turns at break-neck speed! Cutting the curves too sharp or too fast means an upset—another case of failure at the turns.

The same danger lies at turns in *piping systems.* Wherever there is a change in flow direction, the strain imposed by the flow speed and pressure increases the probability of leakage and failure unless they're *welded* and *protected* with Tube-Turn welding fittings!

Write for helpful Tube-Turn data book and catalog.

TUBE-TURNS, INC., Louisville, Ky. *Branch offices:* New York, Chicago, Philadelphia, Pittsburgh, Cleveland, Tulsa, Houston, Los Angeles. *Distributors in all principal cities.*

TUBE-TURN TRADE MARK — The FIRST WELDING FITTINGS 1ST AND STILL THE BEST — *Welding Fittings*



be utilized and the ammonia discharged to stack, or recovered by bubbling it through a cracker pipe into water until it is fully saturated.

A makeshift apparatus, however, could be cheaply and easily constructed by obtaining a wood or steel tank with a baffle at one end to separate the drain from the inlet. Cover the tank and connect a fairly large line to the smoke stack to release the gas; mix a 15% milk of lime solution from slacked lime with hot water, about the consistency of a thin whitewash and discharge the milk-of-lime and ammonia solution into the tank. Heat from a perforated steam line at the bottom of the tank will drive off the free ammonia and the lime will free the fixed ammonia; the steam will help to stir the mixture thoroughly, and the water can then be discharged to waste. To test for any ammonia remaining in the waste collect a sample and pour in a little milk of lime, which will release the fumes of ammonia which may still remain.

Kitchener, Ontario, Canada
WILLIAM VICKERS

in such emergency. Control of the two solenoid valves as well as stopping the compressor is accomplished with a double-pole double-throw relay. However, if AST prefers manual control he should omit the solenoid valves, electrical installation and use hand-operated valves instead.

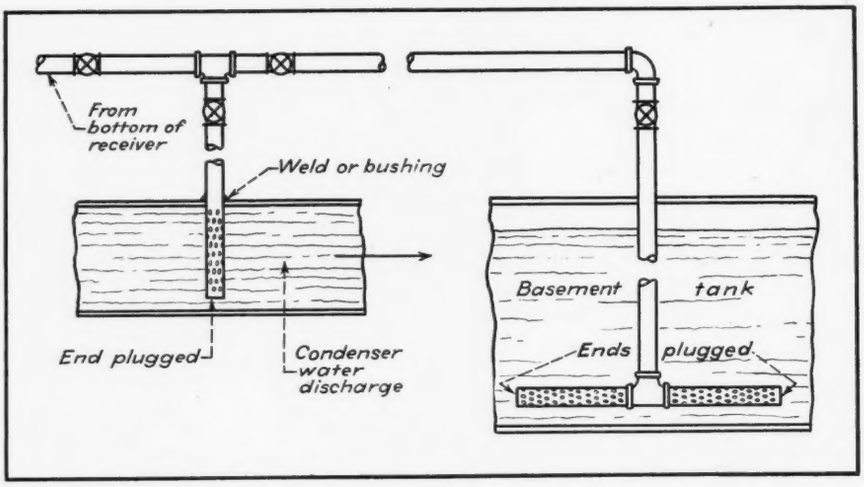
Schenectady, N. Y.
CARL BACHMANN

this time. Should the circulating water be from a spray pond, the same method applies.

Another method would be to run a line down to the bottom of the basement tank and, if possible, have a tee connection with closed ends and perforations along the line as shown. It may be possible to run this line through the manhole; sufficient space must be left in the tank to allow for the increase in volume of mixture.

One pound of water at 60 F will absorb approximately half a pound of ammonia, therefore, with 50,000 gallons of water containing 2000 pounds of ammonia diffused throughout, no trouble should be experienced with fumes.

Kearny, N. J. GEORGE MCNALLY



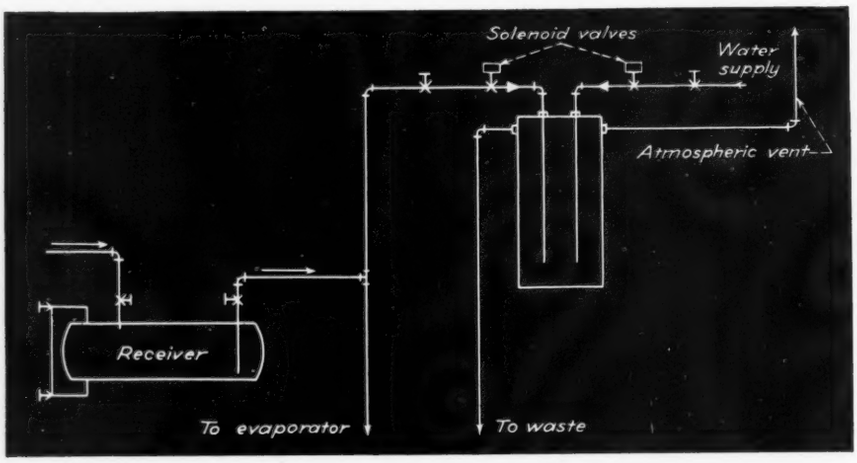
Use Home-Made Mixer, Remote-Control Valves

PERHAPS AST CAN SOLVE his problem with a home-made mixer such as we used to dispose of 3500 lb of ammonia. This can be accomplished by remote control of two solenoid valves, one for ammonia and one for water, with arrangements to stop the compressor immediately. Four stations were installed at different locations with a 2-color pilot signal to indicate the valve position at all stations. The switches were protected by a glass panel and the glass had to be broken to permit authorized people to discharge the ammonia

Connect Ammonia To Cooling-Water Discharge

AS THE PLANT in AST's question has a coastal location we can assume that it is close to the ocean or river mouth. In this case, it would be a simple matter to dispose of the ammonia by simply tapping the return line to the river and leading a line from the bottom of the receiver to the condensing water as it flows to waste.

This ammonia line should be plugged in the end and perforations drilled along the length of it, as shown in the sketch, to assist in diffusion. The circulating pump must be kept in service during



Water Line to Receiver

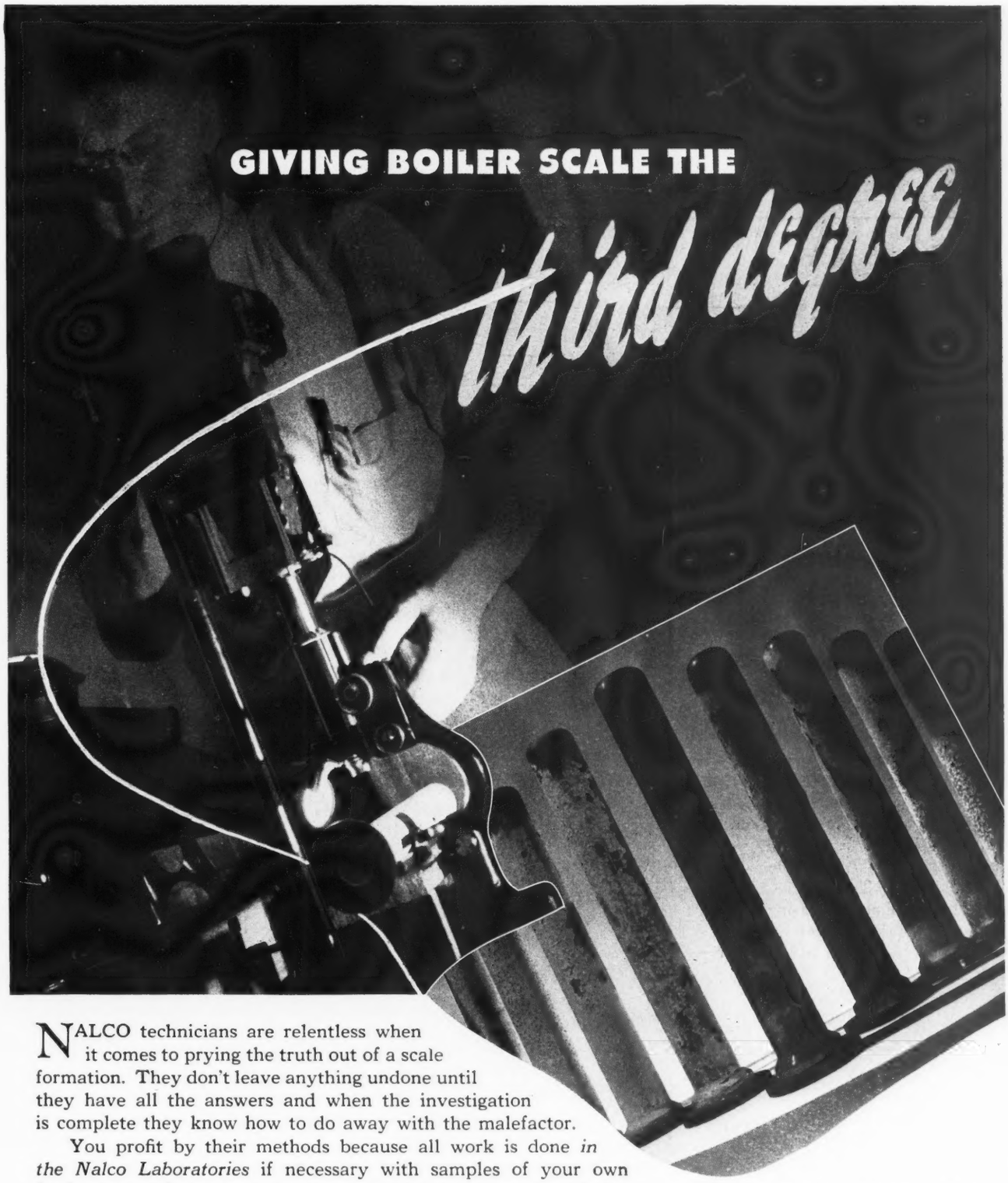
THE PROPER PROCEDURE is to get rid of the ammonia as quickly as possible. The most convenient method is to use water pressure applied to the receiver. This water line can be welded to the receiver. Another line connects the receiver to a mixing tank which discharges to the water storage tank. After the receiver is closed off from the system the water can be admitted. Water and ammonia then flow to the mixing tank where agitation completes the diffusion before the mixture enters the storage tank.

Philadelphia, Pa. T F CUNNINGHAM

Install Adequate Protection Around The Receiver

IT SEEMS TO ME THAT AST has a wrong viewpoint of his problem; he should prepare to keep his ammonia in the system. This is desirable both for safety during a raid and for immediate operation afterward. Any arrangements he might make to discharge it to waste is

(*Continued on page* 140)



NALCO technicians are relentless when it comes to prying the truth out of a scale formation. They don't leave anything undone until they have all the answers and when the investigation is complete they know how to do away with the malefactor.

You profit by their methods because all work is done *in the Nalco Laboratories* if necessary with samples of your own feedwater so that proper treatment to best meet your particular requirements can be evolved.

It will pay you well to investigate the facilities and methods behind the Nalco System. Write today to arrange for a Nalco Survey of your plant — you'll be glad you did.

Large illustration—Making a photomicrograph of scale formation produced in a Nalco experimental boiler.

•

Inset — Typical scale formations produced on steel tubes in Nalco Laboratory experimental boilers.

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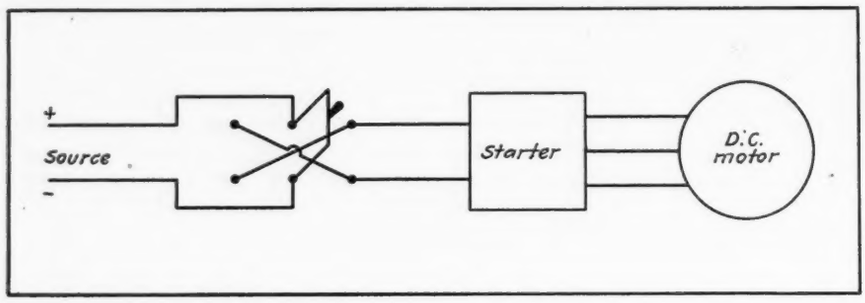


Polarity Affects Brushes

BRUSH WEAR may be caused by contact resistance (see question, POWER, January, 1942, pg 104). This resistance between brush and commutator bars is somewhat higher when current is passing from commutator to brush than when it is in the reverse direction. The brushes which wear faster and are opposite each other have the same polarity. Probably the current in these brushes is flowing from brush to commutator. In this case the contact resistance must be low with higher short circuit currrent in the coils undergoing commutation. This would tend to wear the brushes faster.

In order that all brushes may wear evenly, polarity must be changed at regular intervals. This can be accomplished by installing a reversing switch as shown in the sketch. However, if all brushes wear too fast, a harder brush should be used.

Barranquilla, Colombia, S. A.
NATHANIEL PASARELL

More Evidence On Midland Explosion

I note in the March issue, page 99, that E McDermod of Melrose, Mass., sees fit to take issue with the Old Chief's conclusions in the story of the big Midland boiler explosion of October, 1913.

Well, Mac may be right when he says that the boilers likely would have burst anyhow. But the Old Chief does not agree with him and is joined in that opinion by an eyewitness in the person of Mr Sam Reid, now with the Travelers Insurance Co of Hartford. Mr Reid knew the Midland plant very well and has contributed these photos taken on the day of the explosion, which may be of interest even at this late date.

The reading matter under the photos might be (1, top) Showing the smoke stack and one of the boiler heads which is lying 30 feet away from its base. (2) The bodies of two of the victims of the disaster were found under this pile of debris.

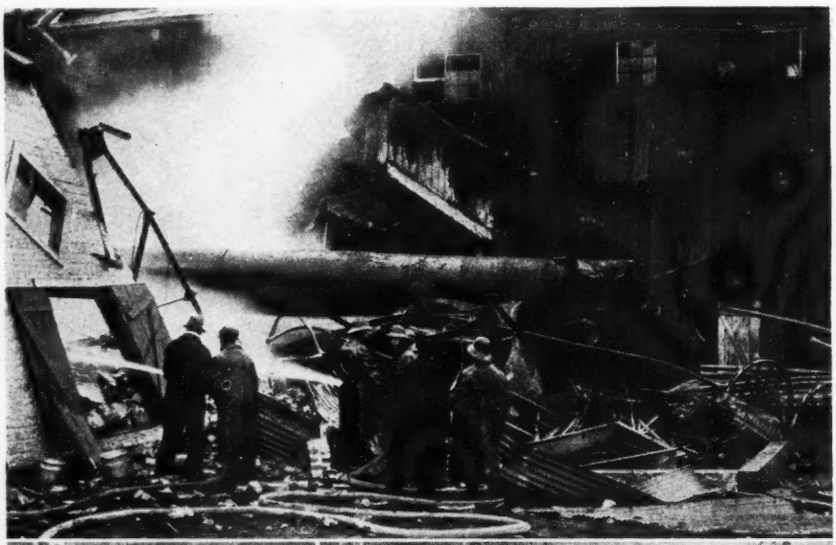
Windsor, Ont. WILLIAM DORAN

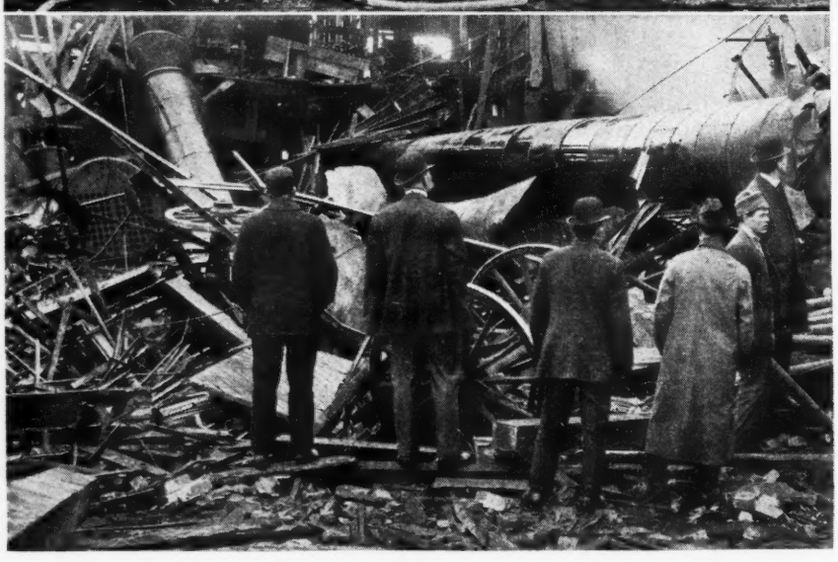
Welding Upper Heads

IN THE MARCH ISSUE of POWER, page 99, Mr Rogers has shown two sketches of repairs on tube sheets of firetube boilers, one being the flush type and the other the lap type of repair to a vertical tubular boiler.

In making repairs to boilers under the National Board regulations referred to by Mr Rogers, the first prerequisite is that the State having jurisdiction shall have adopted the rules for repair outlined by these regulations. If adopted, the next distinction to be made is that of *qualified* and *unqualified* welders, as an unqualified welder is limited to certain specific repairs, generally in cases where the repairs are in the braced or staybolted area. It is suggested that anyone interested in welded repairs on boilers obtain a copy of the new regulations from the National Board of Boiler

(*Continued on page* **144**)





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Our informative new booklet, C-24, "*Anaconda Copper Tubes for Industrial Applications*", is available free on request. 4245A

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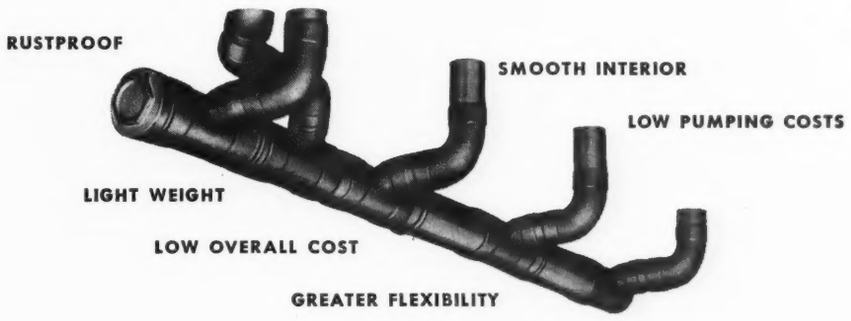

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POWER LINES

Utilities Must Interconnect with Private-Plant Generators

The immediate effect of a recent order of the War Production Board (L-94) puts utilities under obligation to ascertain the amount and availability of any electric power generating facilities in their territories (such as industrial plants with electric generating capacity) and to make arrangements to connect such privately owned generators with the utilities' systems. The order applies to all electric generating plants of 100 kw or more, whether or not they are now interconnected with a utility.

The order further provides that the utility shall take the initiative in arranging for interconnections with private plants (where feasible) by voluntary agreements. Where such arrangements contemplate use of materials in excess of the limitations of P-46, application for authority to acquire and use such materials shall be made to the Director of Industry Operations (WPB) in accordance with established procedures. Where voluntary arrangements cannot be concluded, the utility must report the fact to WPB giving all pertinent information.

Utilities also may not abandon existing generating capacity without specific authorization from WPB. Beginning immediately, utilities are required to coordinate their operations (1) to make available maximum peaking capacity during periods when such capacity is needed (2) to conserve fuel by maximum use of water power and (3) to maintain essential reservoir storage.

Other sections of the order become effective only after WPB declares the existence of a power-shortage area. Specific directions will then be issued to utilities, non-utility power producers and consumers within the area to establish curtailment schedules and put into operation any or all of several power-saving programs. These latter include provisions that

(1) eliminate non-essential lighting and restrict stores, etc, to one watt per sq ft of floor space,

(2) restrict or prohibit use of electric power during peak periods by all consumers except essential transportation, communication, municipal, military and war-production services,

(3) limit delivery of power to industrial consumers to an amount based on a percentage of their previous year's highest demand,

(4) restrict kwhr for large non-residential consumers to a fixed quota, and

(5) restrict kwhr use by residential and small commercial consumers.

No curtailment of power use is mandatory by the order unless and until WPB declares a shortage to exist. Specific emergency schedules will then be enforced only within the defined area of shortage.

Wartime Program for Peoria Diesel Meeting

A round-table discussion of wartime operating problems and numerous timely papers will highlight the 15th National Conference of the ASME Oil and Gas Power Division, to be held June 17–19 at the Hotel Pere Marquette, Peoria, Ill. The SAE Diesel-Engine Activity will cooperate in this meeting, contributing a symposium and several papers.

According to present plans, the round-table session will start with short practical talks by J B Harshman, Stanolind Pipeline Co; C U Pollard, Algona, Iowa; E R Spencer, Cooper-Bessemer Corp; L. Downing, Rock Island Railroad; Lee Schneitter, Ebasco Services; R T Sawyer, American Locomotive Co; A B Willi, Federal-Mogul Corp; and others. In the open discussion period following, operators and engineers will pool their ideas and experience. Users of diesel and gas-engine equipment are invited to bring questions arising out of the special problems of operation and maintenance under wartime conditions.

The SAE will present a symposium on "Control of Lubricating-Oil Consumption in High-Speed Diesel Engines" with the following speakers: M M Roensch, Chrysler Corp; A T Stahl, Mack Mfg Co; M O Teetor, Perfect Circle Co; Stuart Nixon, Sealed Power Corp; W B Sawers, American Hammered Piston Ring Div, Koppers Co; P S Lane, Muskegon Piston Ring Co; and F G Shoemaker, Detroit Diesel Engine Division, General Motors.

Other technical sessions will cover engine design, power plants, and combustion. A trip to the Caterpillar Tractor Co's proving grounds will display diesel-powered tractors and earth-moving equipment in action.

More than 30 leading manufacturers will display the latest in engine and accessory equipment in the largest exhibit yet held in connection with this conference. Considerable interest attachs to the Scientific Exhibit, a new feature, which will include displays from universities and research organizations, and a captured Mercedes-Benz aircraft engine. R W Young, Chief Engr, Wright Aeronautical Corp, will analyze the engineering details of this unit.

(*Continued on page* 198)

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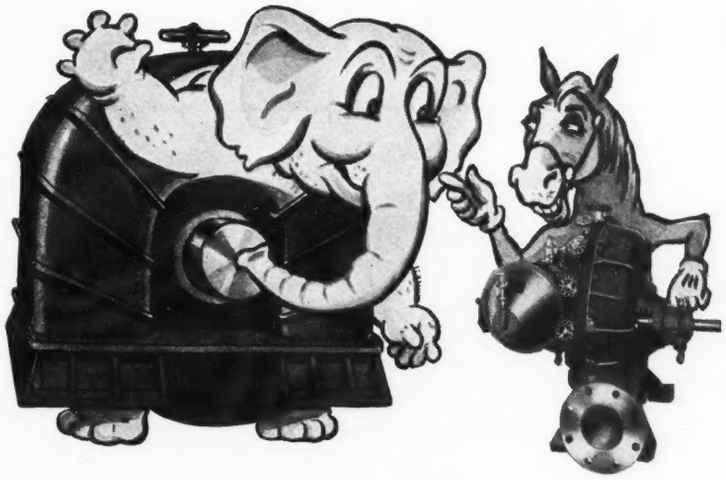

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Coppus "Blue Ribbon" Steam Turbines are built in six sizes (and prices) with ratings from 150 HP (smallest unit in most makes) down to fractional. When a small turbine is all you need, a Coppus will save you investment cost and floor space. Steam, air or gas-operated. Precision-built (like all "Blue Ribbon" products); dynamometer tested. Partial load economy secured by individual nozzle control.

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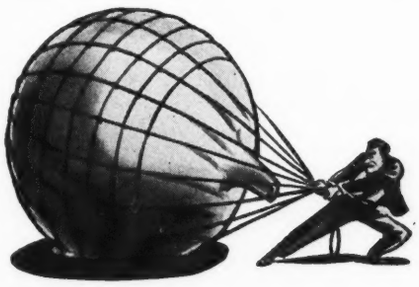

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An Arkansas plant which had installed Coppus-Dennis Fanmix Gas Burner on a kiln, reports getting increased production at a saving of 13.5 % in gas consumption.

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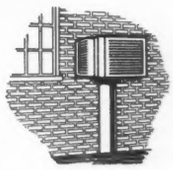

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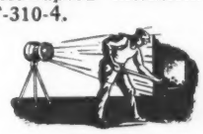

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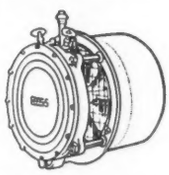

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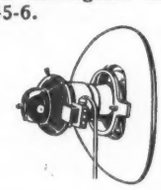

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ENGINEERS' BOOKSHELF

High-Speed Diesels

HIGH-SPEED COMPRESSION-IGNITION ENGINE (1941) *By C B Dicksee. Published by Interscience Publishers, Inc, 215 Fourth Ave, New York, N. Y. 331 pages, 6x9 in., 165 illustrations, cloth cover. Price $4.50.*

Written to cover the principles governing the operation of high-speed diesels and to discuss the problems associated with them, rather than to describe the various engines, this new book should prove interesting to engineers responsible for design of equipment of this type.

Major emphasis is placed on the combustion process, the heart of the problem of high-speed design. Extensive chapters deal with the chemistry of combustion, the losses and limitations of practical engines, the air charge before the admission of fuel, the process of combustion, air movement in C-I engines, types of combustion chamber and fuel injection.

The author points out that engineers developing high-speed engines have had the advantage of the opportunity to accumulate mass experience at a rapid rate and that the intensive study of combustion problems and injection phenomena should be of interest and value to designers of heavy-duty engines.

Electricity

INDUSTRIAL ELECTRICITY — PART II. (Second Edition—1942) *By Chester L Dawes, Associate Professor of Electrical Engineering, Harvard University. Published by McGraw-Hill Book Co, 330 W 42nd St, New York, N. Y. 523 pages, 5½x8 in.; 359 illustrations, cloth binding. Price $2.75.*

Even though this book has been written for a college text it is well suited to industrial engineers who wish a reference on alternating-current circuits and equipment. It presents in an easily read form the principles of alternating current and alternating-current circuits and shows their application to generators, motors, transformers, rectifiers, electron tubes and power transmission. This new edition has been expanded and revised to bring it up to date and make it conform to modern practice. The theory has been extended to include several new subjects and in the chapter on alternating-current measurements recent improvements in measuring instruments and in the electro-magnetic and cathode-ray oscillographs have been included. Chapters on alternating-current generators, motors, transformers and converters have been enlarged with new material on their operation and construction. A new chapter has been added on rectifiers of both large and small designs such as mercury-arc, oxide-film, thyratrons and ignitrons. A more detailed analysis of electron tubes has been given than in the previous edition and new material added on these tubes. The two chapters on illumination and interior wiring in the first edition have been omitted to make room for the enlarged treatment of the other subjects. Those who wish a better understanding of the practical theory of alternating-current machinery and circuits will find this book very helpful.

Thermochemistry

THERMOCHEMICAL CALCULATIONS — 1941—*By Ralph R Wenner, Ph D. Published by the McGraw-Hill Book Co, 330 West 42 St, New York, N. Y. 384 pages, 6x9-in. graphs, cloth cover. Price $4.00.*

Assuming that the reader has come in contact with some formal exposition of the principles of thermodynamics, the author has foregone an elaborate repetition of well-developed theoretical concepts and has developed, in the first eight chapters, a brief presentation of principles and their application to thermodynamic problems. The remaining chapters apply basic principles to practical technological problems.

The usual treatment of partial molar-heat capacities and heat contents of aqueous solutions has been expanded in order to include the modern method of computing and correlating the results of experimental investigations in this field. The chapter on enthalpy-changes accompanying chemical reactions also presents some of the more recent experimental and theoretical developments in this branch.

The main purpose of the book, as stated by the author, has been to collect the most important methods or tools available for use in thermodynamics and to demonstrate, by means of solved problems, their application to a wide variety of problems encountered in various branches of technology.

Air Conditioning

TECHNICAL AND ECONOMIC BASES FOR SELECTING AIR-CONDITIONING INSTALLATIONS (In Spanish—1942) *By Jules Podnossoff, ME, General Electric Co, SA. Reprinted by Instituto Argentino de Electricidad Aplicada, Avenida Roque Saenz Pena 893, Buenos Aires, Argentina, from a series of articles in* La Ingenieria, *official publication of the Argentine Engineering Center.*

POWER's readers in Latin America and Spanish-reading engineers everywhere will be interested in this timely publication covering the purchase, specification and rational selection of air-conditioning equipment and the applications of this rapidly expanding art in Latin America. Mr Podnossoff, widely known for his work in refrigeration and air-conditioning, divides the general subject into three parts: (1) comfort standards, (2) technical aspects, and (3) economic and financial considerations. Each part contains a discussion of fundamentals as well as technical details and data.

Lighting

FLUORESCENT LIGHTING MANUAL — (First Edition, 1942)—*By Charles L Amick, Nela Park Engrg Dept, General Electric Co. Published by the McGraw-Hill Book Co, 330 West 42 St, New York, N.Y. 312 pages, photos, graphs, tables, cloth bound. Price $3.00.*

Fluorescent lamps, since their introduction in 1938, have captured the fancy of the lighting public. Although fluorescence was recorded as early as 1602, and was mentioned in 1896 by Thomas Edison, the perfected fluorescent as we know it today was not available. Other electric-discharge lamps, such as the Cooper-Hewitt, neon-sign tubes, etc, are commonplace, but a general understanding of their action has never before become general knowledge.

Combining his technical knowledge with that of other lighting engineers who have written on the subject before, the author has presented in an easy-to-read style a handbook for all interested in fluorescent lighting—makers, contract-

(*Continued on page* 176)

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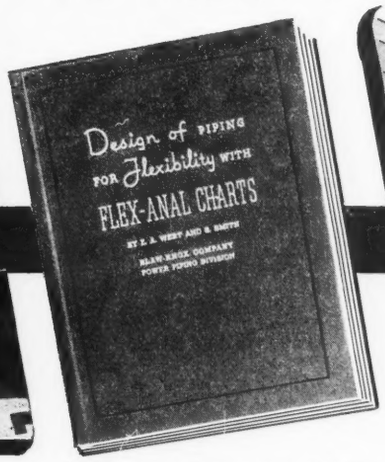

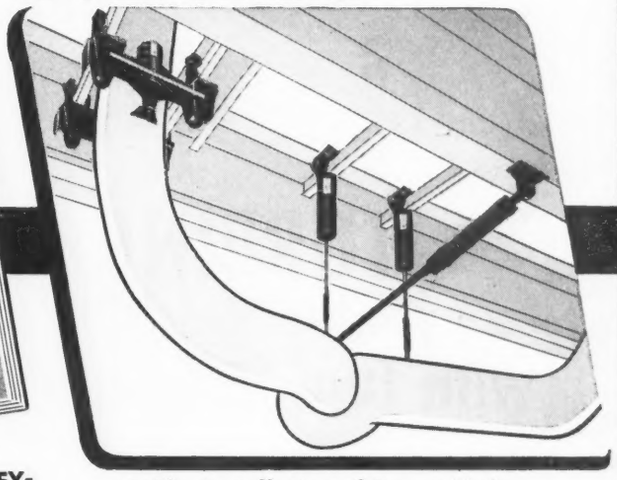

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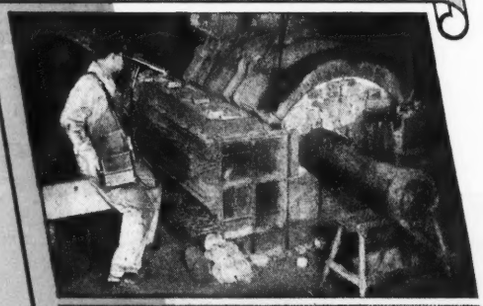

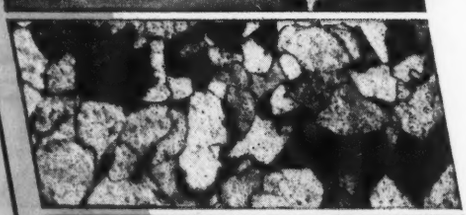

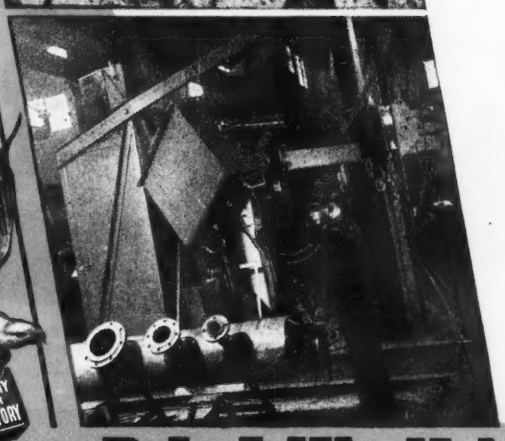

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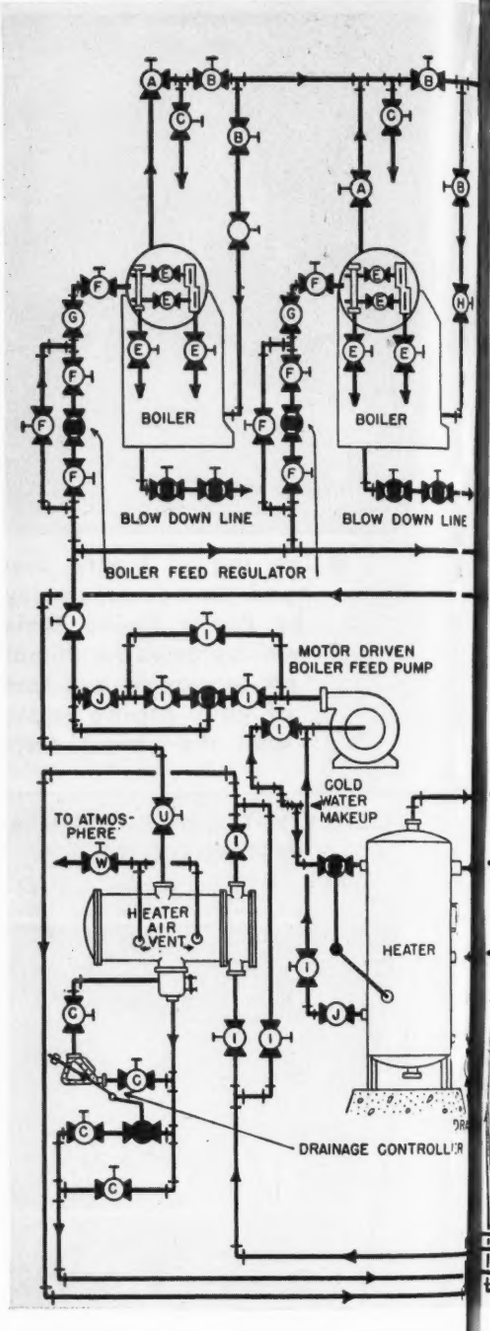
TURBINE CIRCUIT

with Two Stages of Bleed Heating



This diagram shows how greater advantage can be taken of the economies introduced by bleeding steam from the prime mover to raise the temperature of condenser cooling-water, before it is re-circulated through the boiler. Multi-stage heating is used to produce a high feed-temperature, efficiently. A closed heater receives steam at the lower bleed-point to handle the low-temperature heating. From there, the warmed feed-water passes onto a deaerating heater where only a small quantity of valuable high-pressure steam is needed to raise it to its final temperature. It is important that this final temperature be held below the point at which the water would flash into steam in the supply line. Auxiliaries in this circuit are electrically-driven; there would be no economy in using exhaust steam. Two stages of bleed heating are shown; more can be employed, but practice usually limits the number to no more than four.

In the control of this system, you can effect further economies by the use of Jenkins Valves throughout. For experience has proven that Jenkins Valves last longer – require less maintenance – yet cost no more than other "good" valves.

TYPICAL JENKINS VALVES USED IN THIS HOOK-UP

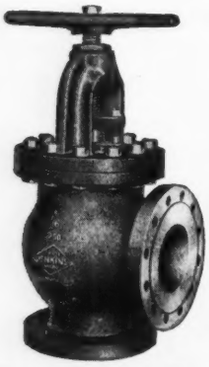


Fig. 293 IBBM Non-Return Automatic Equalizing Stop and Check

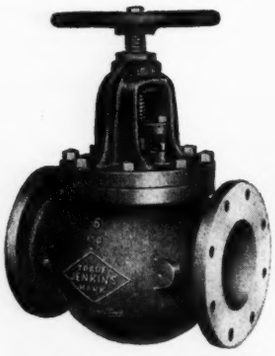


Fig. 142 IBBM Globe Renewable Composition Disc

Fig. 295 IBBM Swing Check Renewable Composition Disc

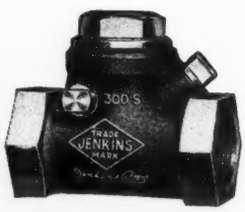


Fig. 962 Bronze Swing Check Regrinding Bronze Disc

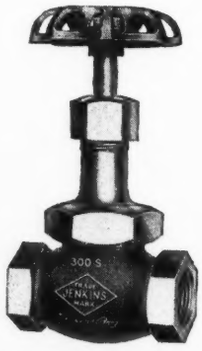


Fig. 976 Bronze Globe Stainless Steel Plug and Seat

JENKINS VALVES for every need

POWER'S
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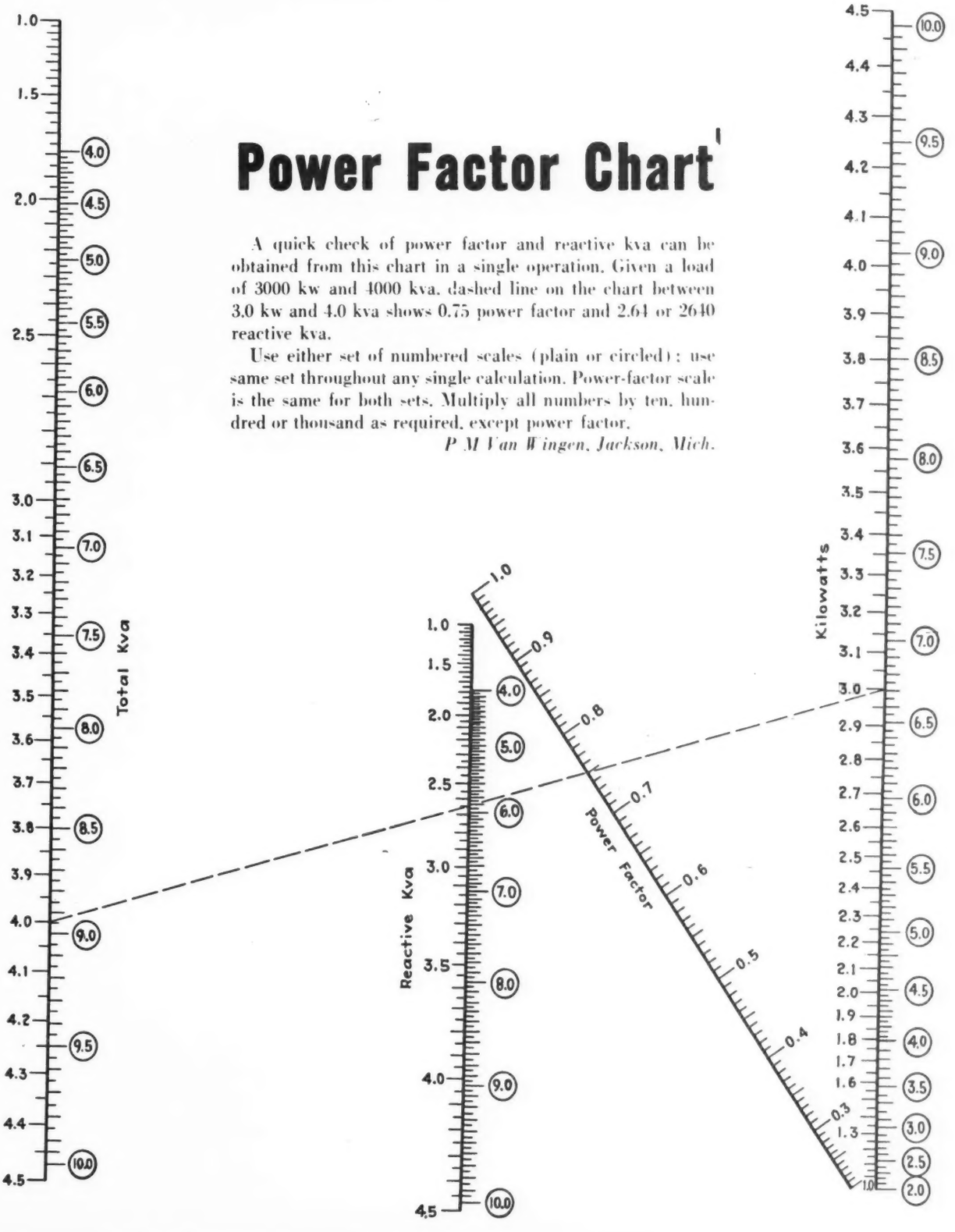
Number 118

Power Factor Chart[1]

A quick check of power factor and reactive kva can be obtained from this chart in a single operation. Given a load of 3000 kw and 4000 kva, dashed line on the chart between 3.0 kw and 4.0 kva shows 0.75 power factor and 2.64 or 2640 reactive kva.

Use either set of numbered scales (plain or circled); use same set throughout any single calculation. Power-factor scale is the same for both sets. Multiply all numbers by ten, hundred or thousand as required, except power factor.

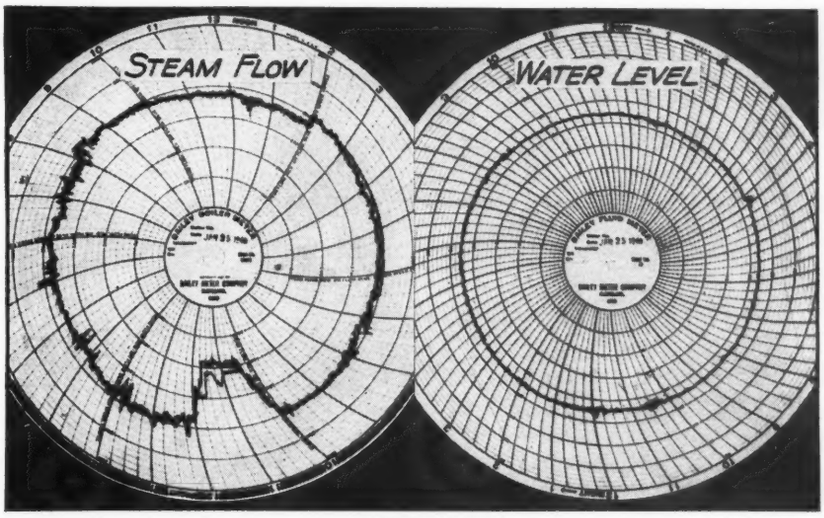
P M Van Wingen, Jackson, Mich.



© POWER

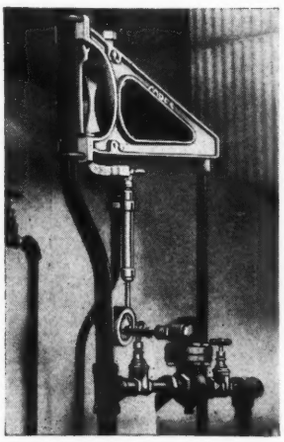
1300 POUNDS W. S. P.

Fired with pulverized coal or oil, this 1300-lb. B. & W. boiler in prominent Eastern utility plant normally evaporates 275,000 lb. per hour with a maximum 300,000 lb. Excess water pressure at pump discharge is 250-300 lb. Boiler water level held within plus or minus one inch of normal by the COPES Flowmatic.



★ *High excess water pressures have little effect on the level control*

FOR SMALL BOILERS



On small boilers at moderate ratings and pressures, the COPES Type OT quickly pays for itself with correct, continuous feed that means more steam per pound of fuel. Makes operation safer by stabilizing water level. Fully-automatic, it saves time for operators. Write for Leaflet P-2A.

YOU need not worry about high excess water pressure if a COPES Flowmatic Regulator controls the boiler feed and water level. These charts show water level varying only plus or minus one inch with an excess pressure of 250 to 300 pounds. In other cases, the Flowmatic has continued to hold the level well within desired close limits with excess rising above 450 pounds. And service is dependable because even the relay-operated Flowmatic, used for high pressures, has as few parts as possible and each part is built to stand up under much more severe conditions than it will meet in operation. Write for Bulletin 429.

NORTHERN EQUIPMENT CO., 621 GROVE DRIVE, ERIE, PA.

Feed Water Regulators, Pump Governors, Differential Valves
Liquid Level Controls, Reducing Valves and Desuperheaters

BRANCH PLANTS IN CANADA, ENGLAND REPRESENTATIVES EVERYWHERE

★ GET CLOSER LEVEL CONTROL WITH THE COPES FLOWMATIC ★ REGULATOR

WHAT'S NEW IN PLANT EQUIPMENT

Insulation Tubing

TUBING HAS EXCELLENT RESISTANCE to brittleness down to —50 C. Transflex is fibronized tubing available from size No. 24 to 1¼ in. inside diameter. Photo shows extreme flexibility. Has tensile strength of from 3400–3600 psi. Dielectric strength (conducted on a tubing with a wall thickness of approximately .020 in.) is 850 VPM when dry, and 815 VPM when wet. *Irving Varnish & Insulator Co, Irvington, N. J.*

Tool Stand

SCHERR TOOL STAND is designed primarily to serve as a vise or clamp for holding micrometers, snap gages and other tools. It is generally known that if micrometers, gages, etc, are held in the hand, heat transmitted to the frame will expand and distort them sufficiently to make accurate reliable measurements impossible. For serious measurements and for setting micrometers, gages, etc, the tools should be placed in a vise, isolating them from body heat. Tool stand has been so constructed so that micrometer or snap gage may be held securely without damage to finish. Jaws are parallel, without serrations. Jaws may be swiveled from vertical position to horizontal, and the base is cast iron with jaws of cold rolled steel. Illustration (left) shows inspector using gage without stand. At the right inspector is using tool stand, freeing both hands for checking the work. *George Scherr Co, Inc, 128 Lafayette St, New York, N. Y.*

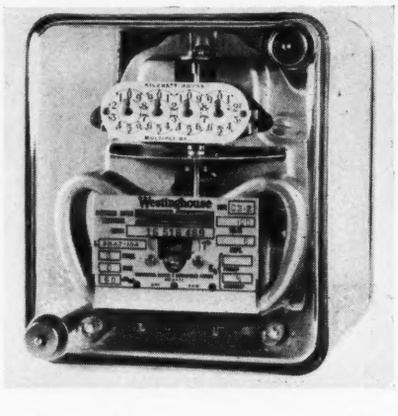
Signal Lamp Blackout Shield

HELMET-LIKE BLACKOUT CAPS are to shield the red glow of signal lamps on outdoor electric transformers. Signal lights contain only 5-watt lamps and are not noticeable when bright street lights are on around them. But with

blackout of cities against air raids, these tiny lights glow brightly. Caps snap on over the red lights, which flash on when transformers are in danger of becoming overheated. A small hole in one side of the cap lets a narrow beam of light shine downward to guide service men, but no light can be seen from above. *Westinghouse Electric & Mfg Co, East Pittsburgh, Pa.*

Watthour Meter

TYPE CB WATTHOUR METERS are for industrial and central station use. Mounting styles are flush, projection, and a detachable or plug-in construction. Detachable models can be readily removed

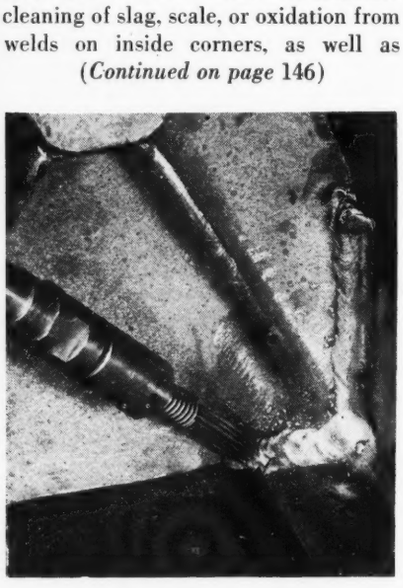


for over-all inspection and test without interrupting circuit. All calibration adjustments are accessible from front when the molded glass covers are removed. *Westinghouse Electric & Mfg Co, East Pittsburgh, Pa.*

End Brush

POWER-DRIVEN END BRUSH is to facilitate cleaning of slag, scale, or oxidation from welds on inside corners, as well as

(*Continued on page* 146)



"My boss wasn't kidding when he said he didn't have time to teach me. Yet, with the plant going night and day, I'm being called on more and more to use my own judgment in handling maintenance problems. That's big responsibility for new men—with piping so important to plant operation. But I'm catching on—with the help of these Crane Piping Pointer Bulletins."

IT IS under such conditions—war production—'round the clock operation—inexperienced maintenance men and no time to train them—that these Crane Shop Bulletins are doing a timely twofold job in many plants. (1) Their many practical hints on better piping practice aid in training and supervising maintenance crews. (2) They help step-up the operating efficiency of pipe lines, and assure maximum service from present equipment.

Piping Pointer Bulletins are a part of Crane Co.'s aid-to-victory program. They are offered *free* to your plant—for your employee training school, for posting in shops, for distribution to your men. Even veteran workers find them helpful. Just ask your Crane Representative; he will be glad to supply them.

HELPFUL HINTS ON CHOOSING VALVES FOR BETTER PIPING SERVICE
TIPS ON VALVE TRIM
TO HELP KEEP PIPING ON THE JOB
VALVES GET CRIPPLED THIS WAY
HOW TO KEEP YOUR PLANT GOING WITHOUT INTERRUPTION!
GOOD!
BAD!
HOW TO SUPPORT PIPING

CRANE

CRANE CO., GENERAL OFFICES:
836 S. MICHIGAN AVENUE, CHICAGO

VALVES • FITTINGS • PIPE
PLUMBING • HEATING • PUMPS

NATION-WIDE SERVICE THROUGH BRANCHES AND WHOLESALERS IN ALL MARKETS

Brains vs Brawn . . . .

A "sidewalk superintendent" was watching a trench being dug with a big trenching machine. He said to the boss: "This machine has taken jobs from scores of men. Why don't you junk it and put a hundred men in that ditch with shovels?"

Said the boss, "Or better still, why not put a thousand men in there with teaspoons?"

I'm reminded of that old story by a clipping from The New York *Sun* of several weeks back. Here's part of it:

> **West Point, N. Y., March 25—One of America's greatest aviation centers is being rushed to completion here . . . Today, the first of three private contractors moved onto Stewart Field with batteries of diggers, bulldozers, and fleet of trucks to rush completion of the grading. The three contractors have just ninety days to move some 9,000,000 cubic yards of fill—more than five times the amount the WPA has been able to move in four years by ancient methods . . . To make way for the private contractors, the WPA will have to be shifted so they will not interfere with the rush work.**

That, I think, is a short, but not sweet, summary of the effectiveness of traditional methods. Back in the depression, there were many who insisted that we should go back to the ways of our forefathers "in order to keep more people employed"—not realizing that such backward thinking would not only actually cut employment, but also would cut buying power through eliminating the "extra money" with which the worker buys many modern products.

Everyone knows that a handmade Ford would cost over $10,000, but few know that many things we enjoy today (as long as priorities let us) actually would be unobtainable except for machines. For example, to produce, by Colonial methods, the cloth we now use, would take all the time of the entire American working population at spinning wheels and looms.

America was built by men who discarded the axe in favor of the power saw, who replaced the horse and wagon with the locomotive, the automobile and the airplane—and who in general used machines instead of men wherever they could.

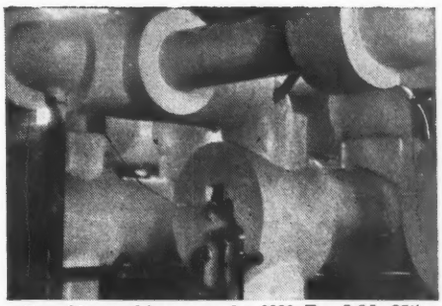
If your plant is using men in any place where machines can be used, you're wasting time, money and manpower. Are you firing by hand, walking over to look instead of using "seeable" gages, handling coal and ash by wheelbarrow instead of mechanically? You can't correct some such conditions now because machines are just not gettable, but you can plan for the changes, assemble your facts and figures, and be ready to grab the machines as soon as you can. In that way you will be building toward Victory—and beyond it to an ever-more-advanced America, capable of giving its people the better things of life because its men are using brains instead of brawn.

George Edwards

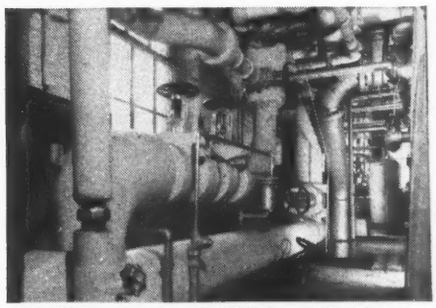
Engineer

For lasting efficiency and maximum fuel savings

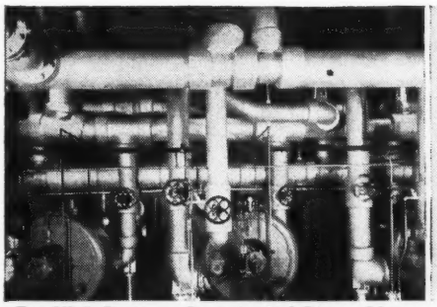
Johns-Manville Insulations



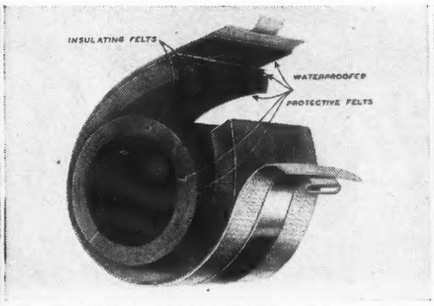
For Steam Lines up to 600° F.—J-M 85% Magnesia Pipe Insulation. Furnished in 3-ft. sections or segments in the following thicknesses: Standard, 1½", 2", 2½", Double Standard and 3" (double layer).



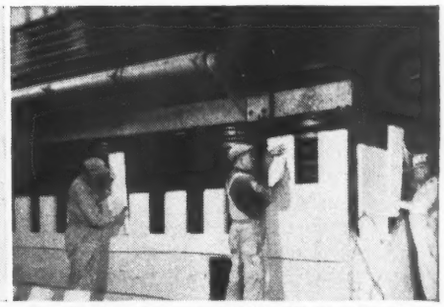
For Steam Lines up to 700° F.—J-M Asbesto-Sponge Felted Pipe Insulation provides high salvage and resistance to abuse. Furnished in 3-ft. sections in thicknesses from 1" to 3", for standard pipe sizes.



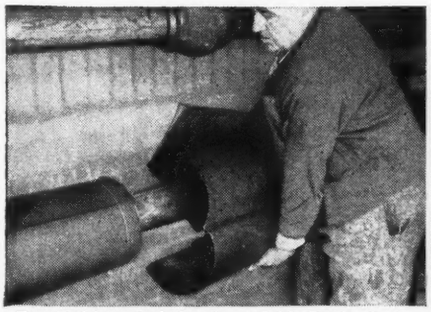
For High-Pressure Superheated Steam Lines—Superex Combination Pipe Insulation. Inner layer of Superex High Temperature Insulation with outer layer of J-M 85% Magnesia. Has unusual heat resistance; high efficiency.



For Cold Water Lines—J-M Anti-Sweat Pipe Insulation. Designed to prevent condensation. In 3-ft. sections; thicknesses, ½" and ¾", solid construction; 1", 1½" and 2", broken joint construction.

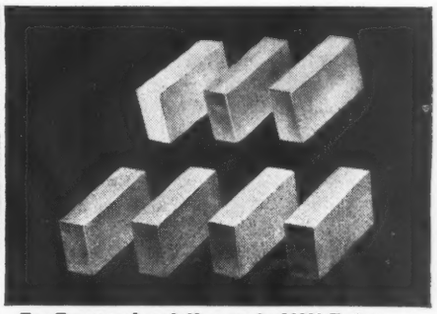


For Boiler Drums, Water Walls, Tanks, Breechings—J-M 85% Magnesia Blocks, highly efficient at temperatures up to 600° F. Sizes 3" x 18", 6" x 36", 12" x 36", flat or curved. Thicknesses 1" to 4".



For Refrigerated Service—J-M Rock Cork. Basically mineral. Can't rot, won't support vermin or mold. In sheets, 18" x 36", 1" to 4" thicknesses. Pipe covering in 3-ft. sections with integral waterproof jacket.

For Furnace Insulation up to 1900° F.—J-M Superex Blocks, for years the most widely used block insulation at these temperatures. Sizes, 3" x 18", 6" x 36", 12" x 36". Thicknesses, 1" to 4", flat or curved.



For Furnace Insulation up to 2600° F. 3 types of J-M Insulating Brick, 4 types of J-M Insulating Fire Brick, are available. Furnished in all standard 9" shapes of the 2½" and 3" series, as well as in specials.

JOHNS-MANVILLE JM PRODUCTS

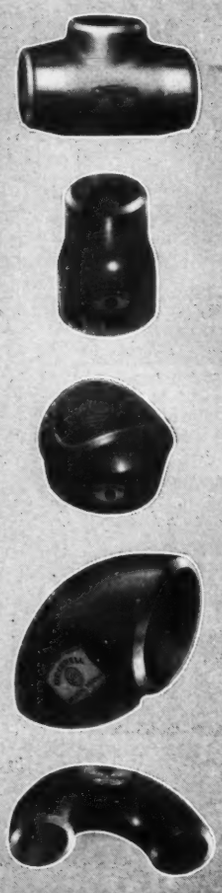
For details on these materials, and on the complete J-M Insulation line, write for catalog GI-6A. Johns-Manville, 22 East 40th Street, New York, N. Y.

Johns-Manville INDUSTRIAL INSULATIONS

For every temperature . . . for every service

Minutes here save hours later!

From 3/4" to 24"



Every hour saved in the erection of your welded piping means just that much more time for essential wartime production. And Grinnell Welded Fittings are precision-engineered to save time on every welded joint!

The illustration shows one typical operation in Grinnell's precision production. In this exclusive process, outlets of all tees and crosses are accurately extruded . . . full wall thickness is maintained . . . field welding is limited to plain circumferential butt welds, the quickest-to-make and strongest welded joints.

Grinnell Welding Fittings arrive on the job exactly *metal-matched* and identical in end-thickness with the pipe or tubing you select. They are accurately dimensioned to specifications, with ends correctly scarfed. You get quicker, better welding . . . joints that pass inspection easily and remain trouble-free.

Save time for all-out production by specifying Grinnell Welding Fittings. Write for complete Data Book. Grinnell Company, Inc., Executive Offices, Providence, Rhode Island. Branch offices in principal cities of United States and Canada.

WELDING FITTINGS BY

GRINNELL

WHENEVER PIPING IS INVOLVED

Readers' Problems

(*Continued from page* 124)

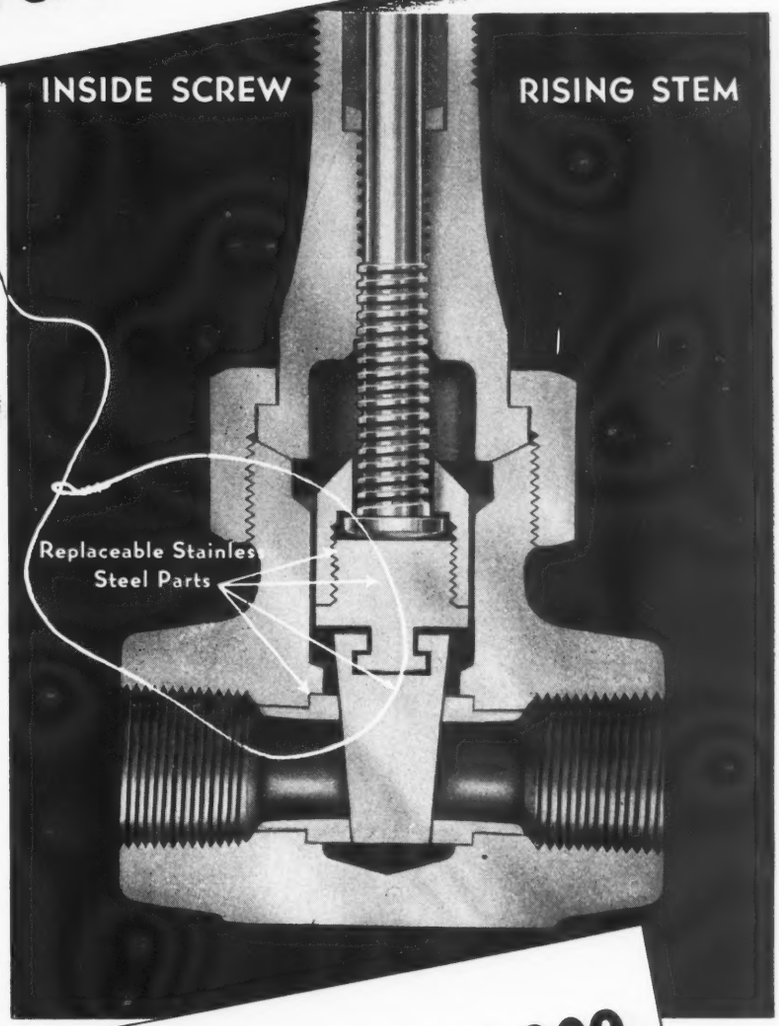
contrary to sound engineering practice. Disregarding the loss of the refrigerant, there is the matter of saving the perishables in stock. If the ammonia is blown into water it is lost, at least temporarily, and days might pass before enough refrigerant for operation could be brought in and charged. In the meantime foodstuffs essential to defense would spoil. Besides, there is no better place for ammonia during a raid than in one or more of the pressure vessels forming parts of the system in which it circulates. The problem is to keep the ammonia in the system during the bombing raid, and have it immediately available for use as soon as service can be restored.

The liquid receiver, whether horizontal or vertical, is a safe place for the refrigerant. This is always an exceptionally strong vessel, with a safety factor of four or five or greater at the usual operating pressures. It will withstand impact, even when charged. The connections are the only weak points about it. This vessel may be regarded as dangerous only when exposed to excessive heat when charged, or when it receives a direct bomb hit, and the chances of this are negligible. It may be made entirely safe from near misses by covering with sand held in place by a box built around the receiver. Before covering with sand, all dispensable fixtures, such as gage glass and air purge, should be removed, and steel plugs screwed into the tap holes. If the quantity of ammonia in a system is generally constant, a gage glass may be dispensed with for an indefinite period.

Only two taps are absolutely essential to the receiver, one at the top for the equalizer connection, and one at the bottom for liquid feed. It is easily possible to connect the liquid line from the condenser to a tee outside and lower than the receiver. This arrangement will permit liquid to feed direct from the condenser to the evaporators, and allow the receiver to take up excess and feed out makeup as required. A master valve beyond the tee can be used to force the liquid into the receiver during a pumpdown.

It is around the evaporators that water absorption is the more likely to be needed. If there is no time for a pumpdown of direct expansion evaporators, one or more common shower heads may be set to spray over each set of coils. A cold-water line for this purpose could be installed and fed from the water tank

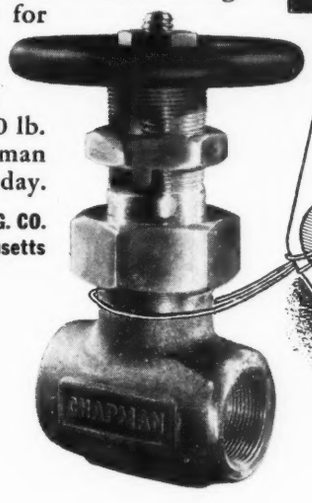
WEAR CAN'T BUCK THESE SUPERHARDENED SEAT RINGS AND PLUGS



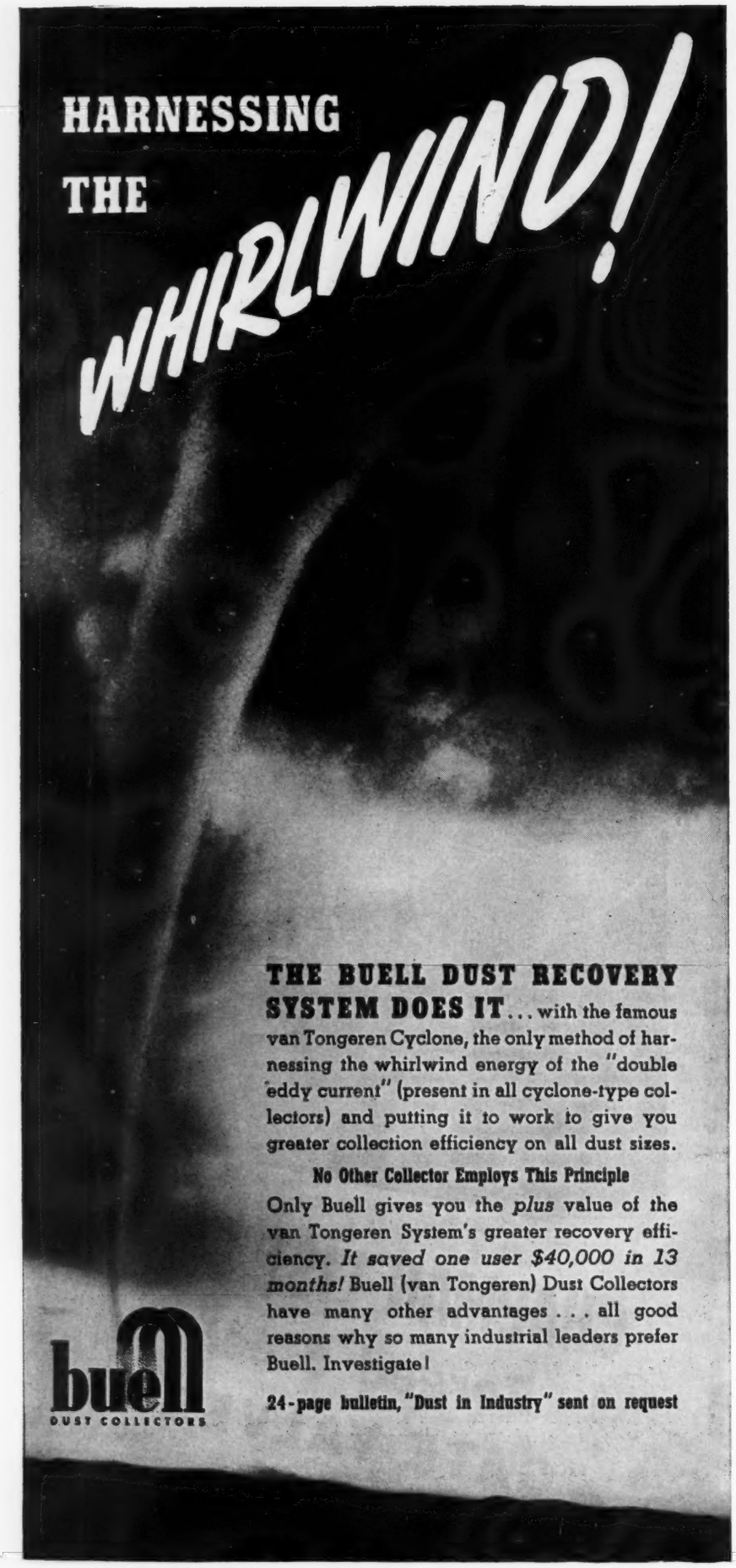
IN CHAPMAN 960 Small Gate Valves

NEW EXCLUSIVE HARDENING PROCESS gives List 960's stainless steel parts a longer life-span than that of any similar small valve. And even then these parts are easily renewable. So this is the small valve to put in, *to put out* all the usual small-valve repairs and replacements for the duration. List 960 is made in a range of sizes from ¼" to 2", with threaded ends on both outside and inside rising-stem types. Rated for pressures up to 800 lb. at 750° F., and for cold working pressures up to 1500 lb. Standardize on Chapman List 960 . . . write today.

THE CHAPMAN VALVE MFG. CO.
Indian Orchard, Massachusetts



CHAPMAN LIST 960 Forged Steel GATE VALVES


HARNESSING
THE
WHIRLWIND!
THE BUELL DUST RECOVERY SYSTEM DOES IT... with the famous van Tongeren Cyclone, the only method of harnessing the whirlwind energy of the "double eddy current" (present in all cyclone-type collectors) and putting it to work to give you greater collection efficiency on all dust sizes.
No Other Collector Employs This Principle
Only Buell gives you the plus value of the van Tongeren System's greater recovery efficiency. It saved one user $40,000 in 13 months! Buell (van Tongeren) Dust Collectors have many other advantages . . . all good reasons why so many industrial leaders prefer Buell. Investigate!
24-page bulletin, "Dust in Industry" sent on request
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DUST COLLECTORS
BUELL ENGINEERING COMPANY, Inc. 10 Cedar Street, New York
NATION-WIDE SERVICE THROUGH OFFICES OF EITHER BUELL ENGINEERING CO. OR B. F. STURTEVANT CO.

by a small pump. Such a water system might prove handy in case of fire, or if the city mains are ruptured in the raid. A direct hit or a very near miss would destroy a piping system, and therein lies the weakness of water protection.

No matter how extensive, the evaporative system must be treated as a single unit, or means provided to effectively and quickly isolate each coil. A single ruptured evaporator will contaminate the air of the entire storage area. For this reason, no evaporator should be allowed to operate flooded, unless that is the system design. To permit rapid evaporation for a forced pumpdown the evaporators should be kept free of frost. No liquid should be allowed to stand in the accumulators, unless such liquid can be safely and quickly trapped and held there. Liquid in an accumulator does not evaporate easily as it cannot acquire heat readily. In case of a ruptured pipeline, a small quantity of liquid in an insulated vessel would render the surrounding air unbreathable for hours. While ammonia gas is much lighter than air when both are at the same temperature, expanding from the liquid state against atmospheric pressure so cools the resulting mixture of air and gas that a downward current is often set up. The toxic vapors may be carried down into places where people have taken shelter.

Pumping down the system and storing the refrigerant in the liquid receiver does not solve the problem completely. Means must be provided to keep it isolated even when one or more parts of the system are ruptured. In this a real problem presents itself, the solution of which depends upon system design. Check valves are effective in preventing return flow. A check valve at the condenser inlet will seal that vessel against a wrecked compressor or a ruptured hot-gas line. Likewise, a check valve on the liquid line to the receiver would seal one outlet of that vessel should the condenser or condenser-receiver liquid line be broken. A check valve in the return line would be of doubtful value.

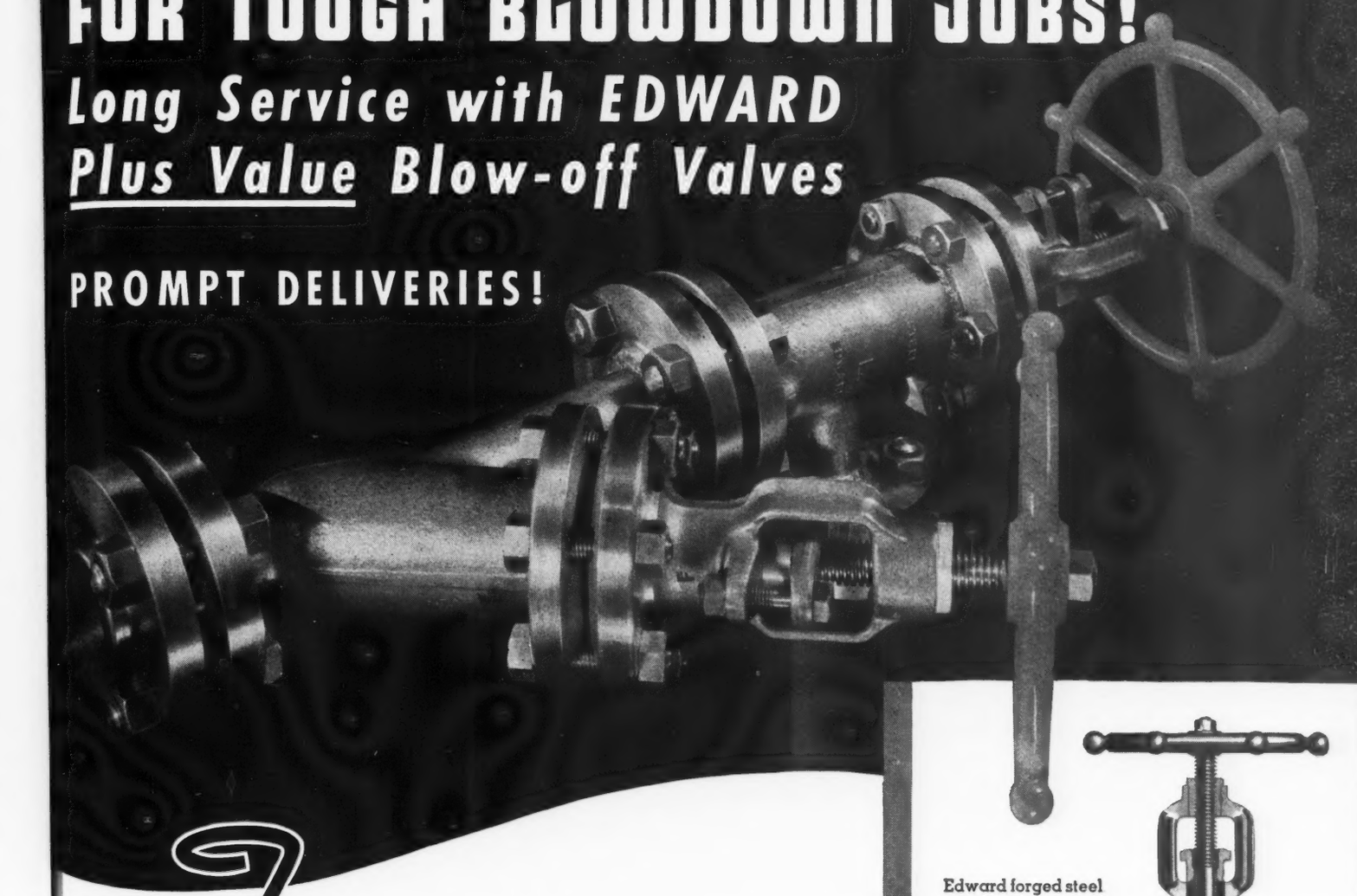
While check valves prevent return flow, the only means of completely and instantly interrupting normal flow is the magnetic stop valve. This valve would be useful in sealing the condenser outlet, the receiver outlet and the equalizer line. One might be worthwhile in the return line on the downstream side of the last evaporator tap. This would isolate the evaporators in case of a ruptured return line, a wrecked compressor or a ruptured hot-gas line and leaking compressor valves.

Menard, Ill. GEORGE HOLMAN

FOR TOUGH BLOWDOWN JOBS!

Long Service with EDWARD Plus Value Blow-off Valves

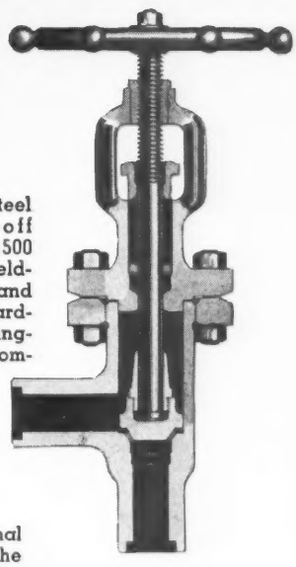
PROMPT DELIVERIES!



FOR exacting power plant, marine, oil field boiler or process piping blowdown service, you can't beat Edward steel blow-off valves. Simple functional design eliminates all frills and unnecessary parts that may cause clogging, and which are subject to erosion, frequent adjustment or replacement. The globe type seating design means tighter closure and less leakage. Slow opening type avoids damaging shock to piping. Seats and disks are wear-resistant EValloy stainless steel, or hard surfaced. Straightway and angle designs make possible a wide variety of installation combinations to meet space limitations. For 150 to 1500 lb sp service.

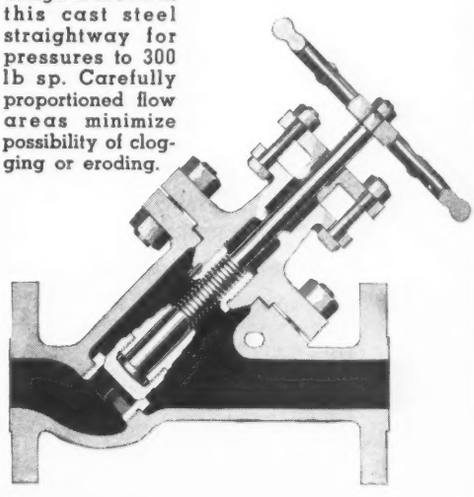
Prompt Deliveries—Large production runs of Edward blow-off valve parts permit quick shipment of many sizes and pressure classes on proper priority. Write or wire for information.

THE EDWARD VALVE & MFG. CO., INC.
1220 WEST 144TH STREET EAST CHICAGO, IND.



Edward forged steel angle blow-off valve for 900-1500 lb sp, socket welding ends. Disk and integral seat hard-surfaced with tungsten-cobalt-chromium alloy.

Typical functional simplicity of the Edward blow-off design is shown in this cast steel straightway for pressures to 300 lb sp. Carefully proportioned flow areas minimize possibility of clogging or eroding.



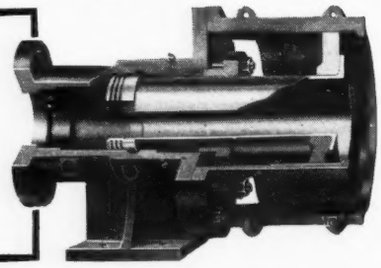
EDWARD *Steel* CAST AND FORGED VALVES

KEEP 'EM ROLLING

Avoid Costly Shutdowns-install ADSCO PISTON-RING JOINTS

Avoid costly shutdowns. Install ADSCO Piston-Ring Expansion Joints —the only slip type joints that can be UNPACKED and REPACKED under full operating conditions without interruption to service.
Piston rings in the internal guide hold the line pressure during unpacking and repacking operations. ADSCO Piston-Ring Expansion Joints are FULLY GUIDED by internal and external guides. Available in single or double joints for high pressure, high temperature service — flanged or beveled ends. Write for Bulletin 35-15PR.

ADSCO
PISTON-RING
EXPANSION
JOINT
FOR STEAM, HOT WATER, OIL OR GAS LINES



AMERICAN DISTRICT STEAM COMPANY North Tonawanda N. Y.

Making "UP-TO-DATE" Steam Line Equipment for over 60 Years

CAN BE PACKED UNDER PRESSURE

Argument Corner

(*Continued from page* 126)

and Pressure Vessel Inspectors at Columbus, Ohio.

Paragraph *B* of the aforementioned rules states that the term *qualified welding operator* means a person who has passed the qualification tests required by paragraph P-112 of the ASME Power Boiler Code.

Paragraph *C* states that an *unqualified welding operator* means a person who has not passed the qualification tests outlined under paragraph *B*. An unqualified welding operator shall not make any welding repairs that are required by the regulations to be made by a qualified welding operator. The American Society of Mechanical Engineers has now published a code. Welding Qualification—1941, which can be obtained by those interested in the qualifications of welders.

Mr Rogers apparently has not perused paragraph 24, on page 5 of the National Board Rules very carefully, for it states that the type of repair shown in his Fig. 2 can be made by an unqualified welding operator. However, paragraph 25 states as follows: "Patches that may be applied to the tube sheets of firetube boilers by a qualified welding operator include in addition to paragraph 24 the following: Replacement of that part of a tube sheet or head comprising all or part of the tube hole area in any type of firetube boiler may be effected by the use of a flush-type patch.

Mr Wiggins in POWER, November, 1941, pg 111, carefully stated that such a repair should be approved by an authorized inspector, and inasmuch as it is a major repair the inspector would doubtless be contacted; if the National Board Rules have been adopted by the state involved the inspector could safely advise the repair as outlined by Mr Wiggins, merely stating that the welding should be done by a *qualified* rather than an *unqualified* welding operator. If the repair is to be made by an unqualified welding operator, then it should be made as shown in Mr Rogers' Fig. 2, but if made by a qualified welding operator, then the type of repair shown in Fig. 1 can be employed (POWER, March, 1942, pg 99).

For Mr Rogers' information, the repair as outlined by Mr Wiggins has been standard railroad practice for many years and where the repair was not prohibited by state law, it was usually made as indicated by him.

Useful *Data* on Alloys for Power Engineers

Booklet on INCO Nickel Alloys covers Corrosion and Heat Resistance, Mechanical Properties, Applications and Forms

THE twin advantages of strength and resistance to corrosion are well-known attributes of Monel,* Nickel and Inconel.* This same combination of properties is also characteristic of the five newer INCO Nickel Alloys . . ."K" Monel,* "R" Monel,* "KR" Monel,* "S" Monel* and "Z" Nickel.*

In addition, however, each of these alloys possesses individual properties such as heat resistance, extra hardness, spring properties, free-machinability and others. For a given application, therefore, there is one INCO Nickel Alloy which from the standpoint of fabrication, service, or both, will prove more suitable than the others.

Comparative data on all of these metals is accordingly desirable. Such information has been compiled and published in the booklet, "Individualized INCO Nickel Alloys." For copies of this booklet, please mail the coupon below.

★ ★ ★

INCO *Nickel Alloys in War Effort* With the Nation at war, every pound of Nickel, Monel and Inconel that expanded facilities can produce is urgently needed for vessels of the Navy, mechanical and chemical equipment for the Army, vital parts of Aircraft, and for Chemical, Petroleum, Steel and other essential industries. As part of the all-out war effort the International Nickel Company will continue to report for the benefit of such users information concerning the selection, fabrication and use of Nickel and Nickel Alloys.

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street **New York, N. Y.**

"Monel" and other trade-marks which have an asterisk associated with them are trade-marks of The International Nickel Company, Inc.

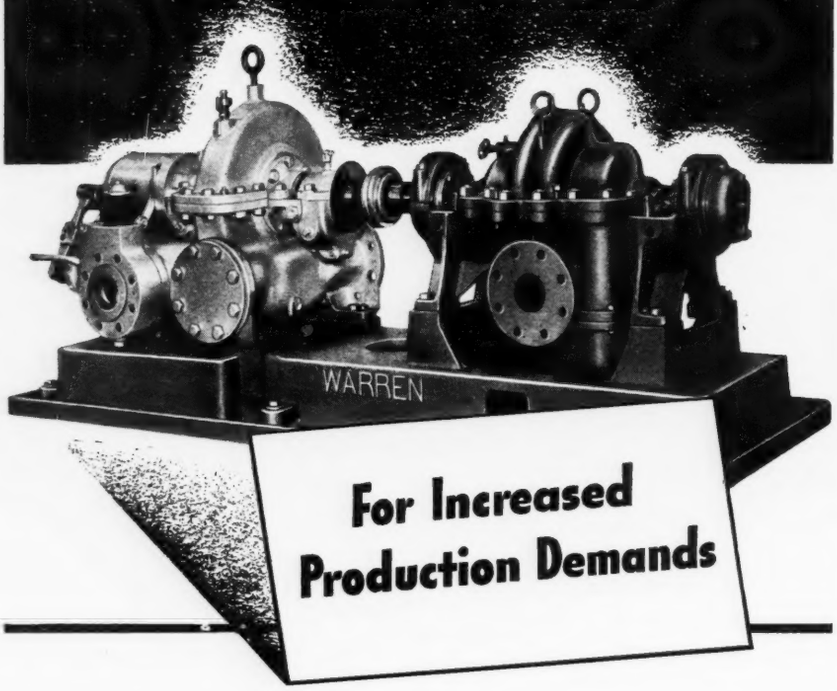
THE INTERNATIONAL NICKEL COMPANY, INC., 67 Wall St., New York, N. Y.
Gentlemen: Please mail ..... copies of the booklet *"Individualized* Inco Nickel Alloys" to:

Name ..... *Title* .....
P-6-42

Company .....

Address .....

WARREN PUMPS HAVE RESERVE CAPACITIES



EVEN though Warren Pumps are "built to fit the job"—to operate at a certain capacity—they are frequently asked to step up their capacities to meet increased production needs. *And Warren Pumps are able to meet these new demands* because of the way they have been designed and built.

Here are some of the design-facts of a Warren Pump that helps explain its reserve capacity . . . liberal clearances between impeller and case-rings, extra-heavy shafts, over-size bearings, carefully proportioned liquid passages.

Investigate these Warren features for yourself—if you want pumps that can do *more* than their share.

WARREN PUMPS

WARREN STEAM PUMP CO., INC., WARREN, MASSACHUSETTS

It can be readily visualized that the reason for having an unqualified welding operator insert the repair piece in the side of the boiler is that it would take considerable pressure to push it through the head should the repair be defective, since the tube assists in holding the repair piece in place and restrains it from being completely blown out.

Altoona, Pa. A P B

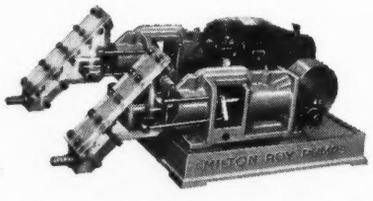
New Equipment

(*Continued from page* 136)

other locations difficult to reach. New brush will get into any space accessible for welding, taking no more room to manipulate than welding tools. Important feature of the new brush is that it can be used in all standard power tools, whether air or electric. This faculty is permitted by special holder which has additional advantage of permitting instant brush part replacement. Brush proper measures only ½ in. across brushing surface, and may be obtained with any one of three diameters of wire. —.025 in., .035 in., and .090 in.—*Osborn Manufacturing Co, Brush Div, Hamilton Ave, Cleveland, Ohio.*

Step Valve

IMPROVED PLASTICS PUMP has step-valve, inlet and discharge connections made entirely from transparent plastics. Pump is recommended for handling alum solutions, hypochlorites, weak acids, mineral and animal oils, and other liquids. "Plexiglas" valve is unaffected by most inorganic solutions, and by acids and alkalis only in high concentrations. Single-piece cover plates for this plastics valve are readily removable



without disturbing connections. Manufacturer states that this valve, similar to those made of corrosion-resistant alloys and other metals, is non-clogging, self-cleaning and eliminates all possibility of air-binding. Transparency of plastics material makes it possible to watch the pump function and to detect discoloration or dirt particles in the liquid as it passes through. *Milton Roy*

Here's a 48 to 60 hour week —by working 40 hours!

Everybody says our greatest shortage in the war program is TIME. Here's how to get the welding output of 48 to 60 hours with no more effort and no more time than 40 hours.

ALTER EGO: And how simple! Just select the proper electrode, use the new "Fleet-Fillet" Technique, boost the current—then speed like blazes!

Speed is right! At 50% operating factor, I used to make 15 feet per hour on these 3/8" fillets. Now, with this new "Fleet-Fillet" Technique, I'm getting 30 feet per hour. Twice as fast!

ALTER EGO: And look at the weld metal you save! All in all, the boss says this new technique has cut welding costs more than 50%.

That's why every welder, supervisor, engineer and executive in metal-working industries should air mail a letter to The Lincoln Electric Company, Cleveland, Ohio, for their book on the new "Fleet-Fillet" Technique so that they can put this time saver to work for Uncle Sam at once.

Free copy "Fleet-Fillet" Bulletin No. 432 on request.

THE LINCOLN ELECTRIC COMPANY
CLEVELAND, OHIO

ALTER EGO: Literally, "one's other self"—the still, small voice that questions, inspires and corrects our conscious action.

In the EVERLASTING
DUPLEX BOILER BLOW-OFF UNIT

1. Tightness

. . . is assured and maintained by the self-grinding seal of the Everlasting Blow-off Valve and the narrow, flexible sealing ring of the Everlasting Companion Angle Valve. In the Everlasting Blow-off Valve, the disc moves across the seat in a *rotating motion* and is in *constant contact* with the seat, thus regrinding the disc against the seat whenever the valve is opened or closed. In the Everlasting Companion Angle Valve, a perfectly fluid-tight seal is provided by the flexible, narrow-face ring which yields to slight irregularities of the sealing surface and the sealing edge as it is compressed between them.

2. Resistance to wear

. . . is provided by the constant spring-maintained contact of disc and sealing surface which prevents grit from getting between the sealing faces of the Everlasting Blow-Off Valve disc and seat; and by the design of the Everlasting Companion Angle Valve in which the sealing elements are not subject to destructive erosion from the flow of fluids.

Made in sizes 1½-in., 2-in., and 2½-in. for 250-lb., 300-lb. and 600-lb. Comply with all code requirements.

EVERLASTING VALVE CO., 49 Fisk St. Jersey City, N. J.

Everlasting Valves

for everlasting protection

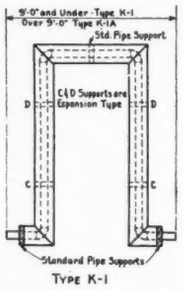
Pumps, 1300 E Mermaid Ave, Philadelphia, Pa.

Weld Spatter Eliminator

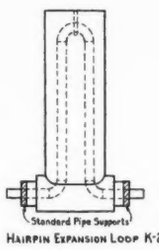
ACME INDUSTRIAL FINISH flash-off No. 99 is designed to eliminate weld spatter. Mechanic simply brushes, sprays or wipes on material along edges of metal surfaces to be joined by weld. When welding is done, metal chips bounce or fall off instead of adhering to areas adjacent to the seam. This eliminates grinding or scratching these chips off. Additional feature of the new product is its cleansing effect to surface to which applied. Prevents pitting on galvanized or ungalvanized metal surfaces and permits immediate application of paint without cleaning operations other than wiping off. *Acme White Lead and Color Works, Detroit, Mich., Department FS-24.*

Expansion Loop

MANUFACTURER ANNOUNCES that he can furnish expansion loops for any system and to any specifications as to kind of pipe, size, or number of pipes required, insulation desired, etc, subject to government regulation. Loops are furnished completely prefabricated and



TYPE K-1



HAIRPIN EXPANSION LOOP K-2

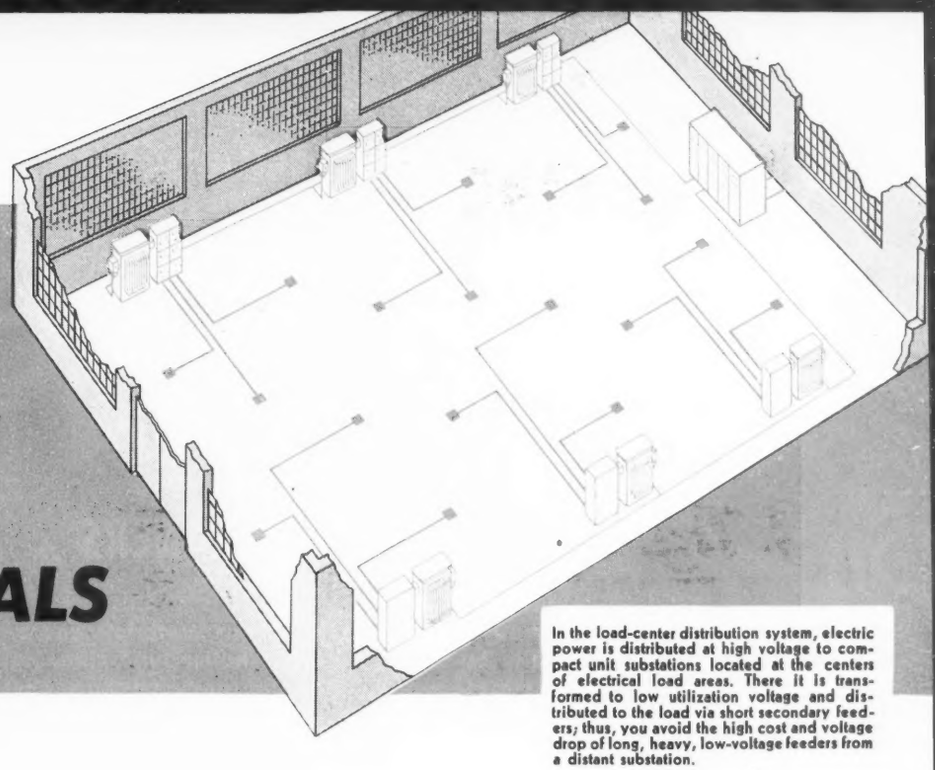
factory sealed and are available for underground or overhead service for lines inside or outside of buildings. Loops can be fabricated in a choice of several types other than K-1 and K-2, illustrated. Available with proper pipe for steam and return or condensate, hot water, oil or combinations of any of these, as specified. An independent laboratory inspection certificate as to construction and test can be furnished if desired. *The Ric-wil Co, Cleveland, Ohio.*

Bomb Shovel

BOMB SHOVEL CARRIES a load of sand in the handle to smother incendiary bombs. Made of galvanized sheet metal and weighs only 17 lb when loaded. Sand is automatically released from the handle after operator has used hollow side of the shovel to smother blazing bomb.

LOAD-CENTER DISTRIBUTION

The NEW *and* BETTER WAY *to distribute* ELECTRIC POWER



In the load-center distribution system, electric power is distributed at high voltage to compact unit substations located at the centers of electrical load areas. There it is transformed to low utilization voltage and distributed to the load via short secondary feeders; thus, you avoid the high cost and voltage drop of long, heavy, low-voltage feeders from a distant substation.

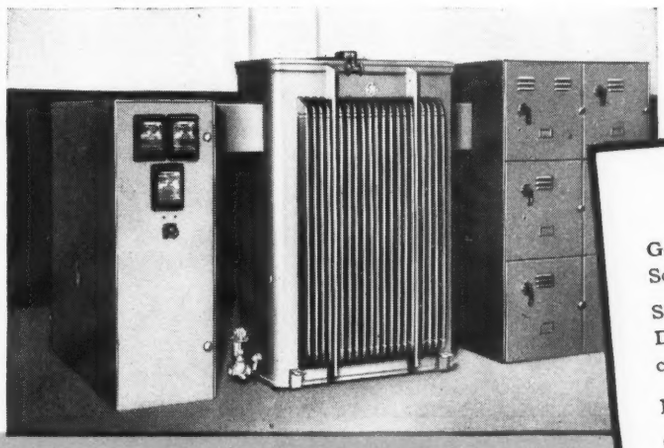
SAVES *TIME, MONEY AND VITAL MATERIALS*

HERE'S the answer to the pressing problem of providing a reliable distribution system, quickly and economically, in today's rapidly expanding plants —the LOAD-CENTER system.

Load-center distribution enables you to install a *better* distribution system in several weeks' less time, at lower over-all cost, and with far less copper and other vital materials than are required for an old-style system. Furthermore, the flexibility of your electric system is increased, engineering and planning time is reduced, and purchasing is considerably simplified.

Basic element of the system is the "packaged" load-center unit substation—a compact, factory-built, entirely co-ordinated unit that's delivered ready to install right in the same room with the machinery to be supplied with power. Thus, you can add substation capacity WHEN you want it and WHERE you need it, largely eliminating the high cost of long, heavy low-voltage circuits from a distant substation. Voltage drop, too, is greatly reduced, thus improving the performance of your electric equipment.

LOAD-CENTER DISTRIBUTION IS FLEXIBLE
Four basic circuit arrangements offer various degrees of service reliability with corresponding variations in first cost.



Load-center unit substations, basic element of the G-E load-center distribution system, are quickly and easily installed (either indoors or outdoors) at comparatively low cost. And they're entirely metal-enclosed for increased safety.

General Electric and its employees are proud of the Navy award of Excellence made to its Erie Works for the manufacture of naval ordnance.

GENERAL ELECTRIC

FOR THE ENTIRE STORY

General Electric Co., Sect. D302-3
Schenectady, N. Y.

Send me your bulletin (GEA-3758), "Load-center Power Distribution," which describes in detail how the load-center system saves time, money, and vital materials.

Name .....
Company .....
Address ..... State .....
City .....

302-3-5900

TO *INCREASE* STEAM OUTPUT AND SPEED UP WAR PRODUCTION —USE WILSON TUBE CLEANERS

The production of thousands of essential war materials *can* be speeded up materially by *faster* and *better* boiler tube cleaning; and the more rapidly these war supplies are produced the sooner victory will be ours.

Clean tubes assure *maximum* boiler efficiency and greater plant production and thus play a most important part in our war effort.

Wilson Tube Cleaners and accessories *reduce* tube cleaning time to a minimum, *increase* boiler efficiency to a maximum and lengthen the time it can remain in use between cleanings. There is a Wilson Tube Cleaner, cutter head, brush or other accessory for *every* tube cleaning need.

Write for the name of our representative nearest to you or for a copy of our NEW forty page catalog fully describing and illustrating the complete line of Wilson tube cleaning equipment.

THOMAS C. WILSON, Inc.
PIPE AND TUBE CLEANERS EXCLUSIVELY
47-28 37th Street Long Island City, N. Y.

TRUSTWORTHY

★ **STANDCO PILLOW BLOCKS**
Built for trouble-free service; machined faces, broached babbitted bore, ample lubrication. Full range of sizes.

Fig. 1635

★ **HALLOWELL STEEL SHAFT COLLARS**
Precision machined, fitted with "Unbrako" Self-Locking Set Screw—and low-priced.

Fig. 1432 Patented

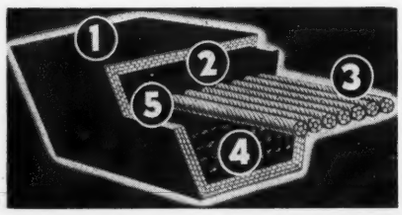
Write for Details

★ **Standard Pressed Steel Co.**
Box 577 JENKINTOWN, PENNA.

When operator raises the shovel slightly, sand pours out of the handle and smothers bomb. Shovel is then turned over and used to scoop up incendiary and remove it. *Industrial Maintenance Engineering Co Ltd, 724 So Spring St, Los Angeles, Cal.*

V-belts

MULTIPLE-V-BELT LINE has been changed and now has black cover that insures longer wear, more uniform pull and higher resistance to heat, oil, etc, according to the maker. Maker also says that new product takes advantage of the fact that the toughest, longest-wearing compounds have always been black in color because of the use of black carbon stocks, whose inherent qualities

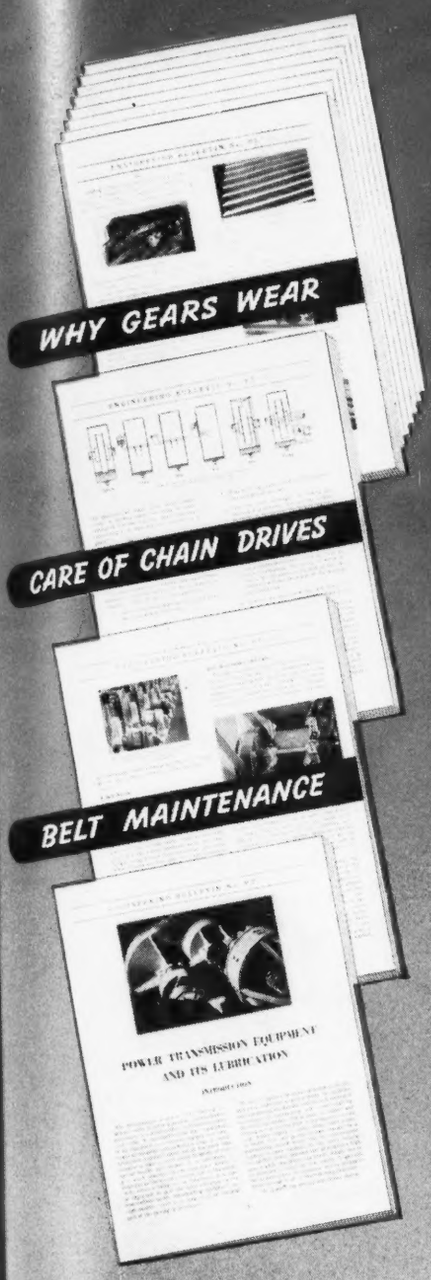


have made them most desirable to the compounders. More uniform pull and better balanced performance results from the fact that it is possible to build this new black cover with more consistent coefficient of friction. Illustration is numbered to show various parts. No. 1 shows heavy, super-tough black cover with uniform friction, longer life, (2) tension section, (3) neutral frames with heavy endless load carrying cord, (4) compression section, and (5) insulating duct. *Goodyear Tire & Rubber Co, Akron, Ohio.*

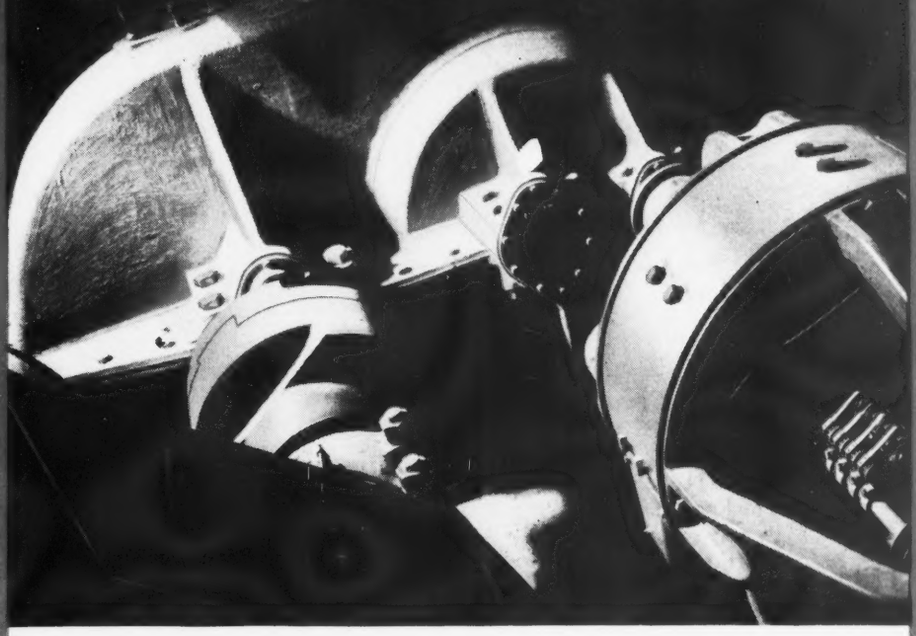
Turbine Pump

HIGGINS TURBINE PUMP is said to handle more than 200 gpm. Pump with either right or left hand rotation is made in the 1¼ in. size. This pump is not self-priming and requires a position on the installation that will keep it primed or a storage tank or foot valve to keep it wet. Pump weighs 20½ lb complete with "B" belt pulley and is constructed of bronze case and impeller with monel metal shaft running in sealed ball bear-

TO AVOID FAILURES ON OVERWORKED POWER TRANSMISSION EQUIPMENT



POWER TRANSMISSION EQUIPMENT AND ITS LUBRICATION . . . This Engineering Bulletin is Free to operators in the Middle West. It discusses the operating and lubrication problems found on common types of power transmission equipment. It will be particularly helpful to men who have taken over new responsibilities in the maintenance of this type of equipment. Just write Standard Oil Company, Room 1223, 910 South Michigan Avenue, Chicago, Illinois, for Bulletin P. T. 1112.



DOUBLE-CHECK LUBRICANTS AND LUBRICATING METHODS

● EQUIPMENT hard-pressed to meet production demands . . . replacements hard to get . . . maintenance just two jumps ahead of trouble . . . Are these the problems you face today in maintaining your power transmission equipment? Then here's a suggestion that may help you.

Take an inventory of your lubrication. See if you can't avoid the penalty of high maintenance by finding the answer to questions like these—

- **Where have lubricating needs been changed by new demands on your equipment?**
- **Are your present lubricants giving adequate protection *now*?**
- **Would better lubricants be a worthwhile investment at this time to reduce replacements of scarce bearings and parts?**

If you are too busy, in these times, to find the answers, get a Standard Lubrication Engineer's help.

He can offer lubricants that meet the new demands. He is working with other plant men on problems exactly like yours. His recommendations will save time spent experimenting with products and lubricating schedules. But let one of these Engineers himself explain just what he does. Write Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago, Illinois, for the Engineer nearest you.

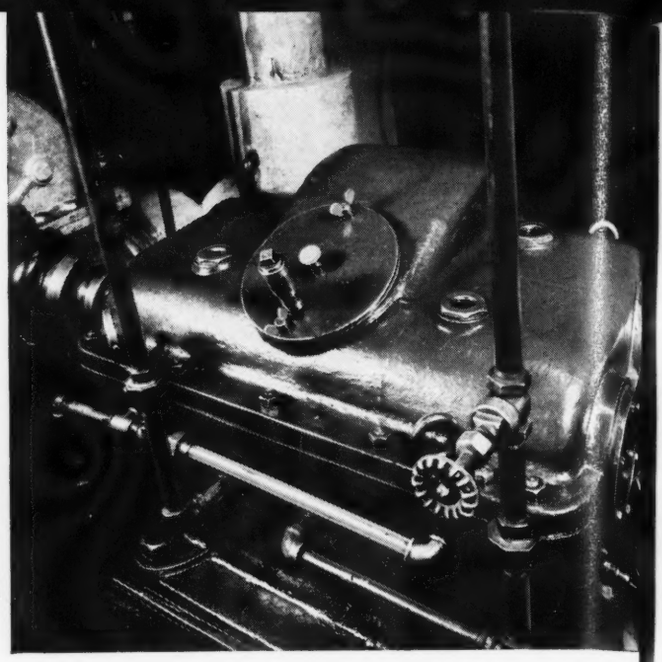
Copr. 1942, Standard Oil Company

STANDARD OIL COMPANY (INDIANA)

LUBRICATION ENGINEERING . . . LUBRICATION ENGINEERING . . . LUBRICATION ENGINEERING . . . LUBRICATION E

NG...LUBRICATION ENGINEERING...LUBRICATION ENGINEERING...LUBRICATION ENGINEERING...LUBRICAT

ONE WAY TO AVOID BEARING REPLACEMENTS NOW... TRY CHANGING LUBRICANTS



• "KEEP OILERS ON THE RUN" was the superintendent's answer to high bearing maintenance costs caused by dusty conditions in a midwest fertilizer plant. It wasn't a happy answer. Crusher, conveyor, and other bearings were greased four times a day with consequent heavy costs for labor and grease.

The only answer seemed to be—redesign the bearings. At least, that's how matters stood when a Standard Lubrication Engineer was handed the problem.

His answer was higher quality grease—Superla. It kept dust out of the bearings, and greasing was needed only once a day. A bearing replacement became a thing of the past. The higher price was easily offset by the savings.

If you have any problem with bearings, see a Standard Oil Engineer before making any costly changes. There's one of them near you and he's ready to help you with your bearing or other machine operating problems.

OIL IS AMMUNITION

USE IT WISELY

CUT SHUTDOWN TIME FOR REDUCTION GEAR CARE WITH STANOIL

A North Dakota power company found it saved both time and money on the reduction gear pictured above. With a conventional oil, sludge formed in the units every three to six months. Then a fill of Stanoil was tried. It ran a full year before it was replaced. Even then, no deposits had formed and the oil was in good condition.

Savings in oil costs—just count them incidental, if you wish. But think of the production time you'd save if your reduction gears and oil circulating systems could be operated two to four times as long before they needed cleaning.

Discuss maintenance problems with a Standard Lubrication Engineer. See if he hasn't suggestions that will help you cut down lost machine time.

TO HELP YOU GET VICTORY PRODUCTION....

As a means of conserving the machines and tools of industry so vital to Victory Production, Standard Oil Company (Indiana) urges plant officials to take advantage of the Lubrication Engineering Service that is available to all manufacturers in the Middle West.

Demands on equipment have been stepped up—lubricating requirements have changed. Lubricating problems similar to those in your plant may have been solved by these Engineers just a week or a month ago in other plants. You can have the advantage of their up-to-the-minute information on lubrication and lubricant developments at no cost to you. Just write Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago, Illinois, for the Engineer nearest you. In Nebraska, write Standard Oil Company of Nebraska at Omaha.

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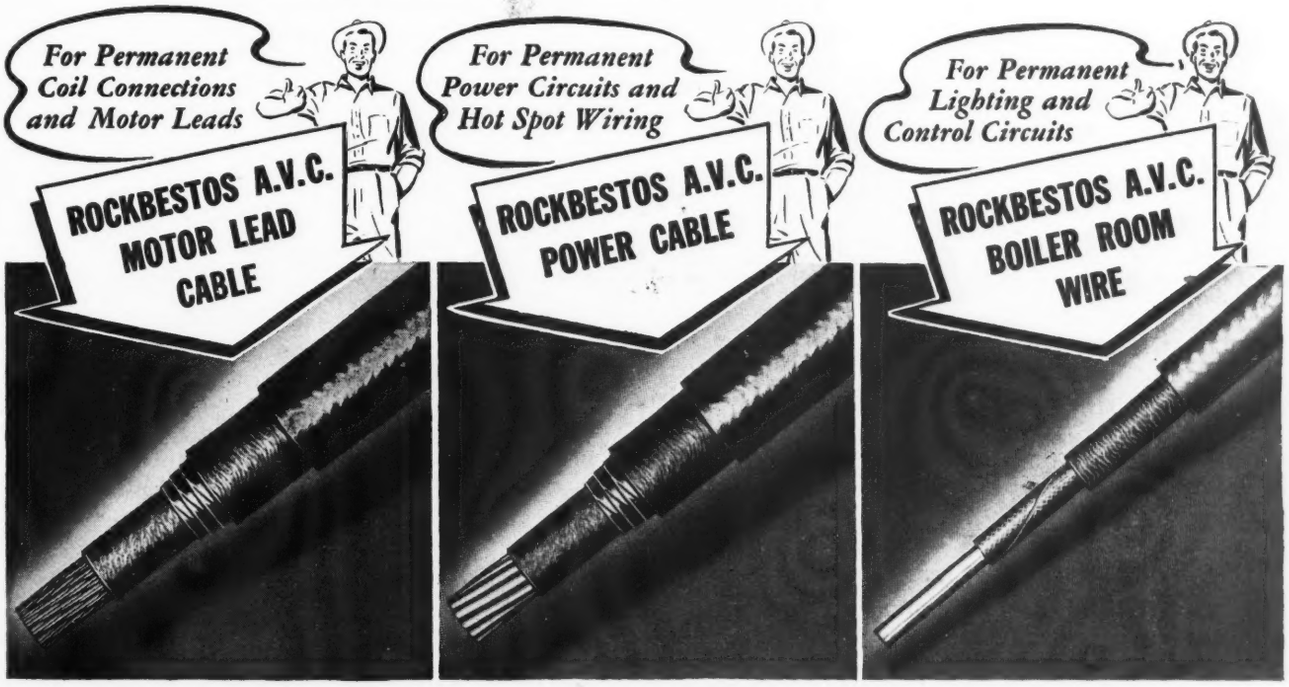
STANDARD OIL COMPANY (INDIAN

Cut Out Non-Essential Jobs in Essential Industries

WITH ROCKBESTOS A.V.C.

Repeated rewiring jobs are non-essential *because they can be prevented.* Use of the wrong wire for severe operating conditions needlessly ties up machines, labor and production with frequent failures—failures that can be *practically eliminated* by using Rockbestos A.V.C. in the hot spots; around boilers, furnaces, steam lines, ovens, soaking pits and places where heat and moisture, oil, grease and corrosive fumes cause wire to fail too often.


For Permanent Coil Connections and Motor Leads
ROCKBESTOS A.V.C. MOTOR LEAD CABLE
For Permanent Power Circuits and Hot Spot Wiring
ROCKBESTOS A.V.C. POWER CABLE
For Permanent Lighting and Control Circuits
ROCKBESTOS A.V.C. BOILER ROOM WIRE

For coil connections, motor and transformer leads. Resists heat, flame, moisture, oil and grease. Insulated with felted asbestos, varnished cambric, felted asbestos and asbestos braid. Sizes: No. 18 AWG to 1,000 MCM—600 volt. Underwriters' and Nat. Elec. Code Type AVA, max. operating temperature 110° C. (230° F.)

For power circuits and general hot spot wiring in boiler rooms, steam tunnels, etc. Laminated felted asbestos—varnished cambric insulation and asbestos braid is heat, flame and moisture resistant. 600 to 8000 volt ratings. No. 18 AWG to 1,000 MCM, 600 volt, Underwriters' and Nat. Elec. Code Type AVA, max. operating temperature 110° C. (230° F.)

For lighting and control circuits exposed to heat and moisture, corrosive fumes, oil, grease or fire hazard. Insulated with varnished cambric, felted asbestos, and asbestos braid. Sizes: No. 18 AWG to 4/0—600 volt (No. 6 to 4/0 insulated like Power Cable). Underwriters' and Nat. Elec. Code Type AVA, max. operating temperature 110° C. (230° F.)

IMPORTANT: *Deliveries are now governed by end-use as well as priority preference ratings. Send in preference rating papers and end-use classification when ordering. Keep your requirements to the minimum. Catalog on request.*

ROCKBESTOS — PERMANENTLY INSULATED WIRES AND CABLES

ROCKBESTOS A.V.C.

The Wire with Permanent Insulation

ROCKBESTOS PRODUCTS CORPORATION, 851 NICOLL STREET, NEW HAVEN, CONNECTICUT

CASH IN on the EXTRA Dart Dividends

. . . Find and Use your Old Dart Unions again

You're in luck if you have some "retired" used Dart Unions around your plant. Why? Because you can put them back on the job with the assurance that the equipment will again give "tight as new" dependability.

The extra dividends that Dart Unions pay in trouble-free performance and long life are due to their special features. Matched bronze seats, ground to "true-ball" surfaces make it possible for Darts to be used again and again, with "first-time" tightness. Nuts and bodies made of air refined malleable iron give Dart Unions the ability to take rough handling, resist pipe strains and corrosion.

Make a search of your plant to get the extra dividends of *old* Dart Unions. See your supplier for the extra dividends of *new* ones.

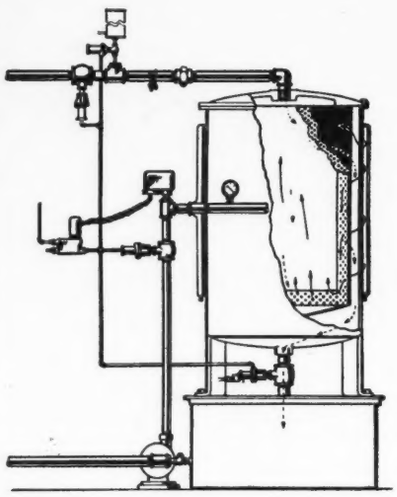
DART UNIONS

E. M. DART MFG. CO. PROVIDENCE, R. I.

ings lubricated. Important advantage is the fact that no galvanic corrosion action can occur through contact between the bronze body and the "K" monel shaft. These two metals are galvanically neutral. Photograph shows pump with pulley attached and casing removed to show impeller. *Higgins Industries, Inc, 521 City Park Ave, New Orleans, La.*

Oil Clarifier

HIGH-FLOW OIL CLARIFIER will remove abrasives from cutting and honing oils and coolants at a high rate of speed. Removal of abrasives from cutting and



honing oils as fast as they are liberated insures better finishes and increased production, according to the maker. The cycle of operation of this clarifier is completely automatic and it is self cleaning. Unit is manufactured in three sizes having a capacity of from 60 to 100 gpm. *Honan-Crane Corp, Lebanon, Ind.*

Submarine Thermometer

TAYLOR 5-IN. INDUSTRIAL thermometer is designed for limited space or on equipment subject to vibration. Designed for Navy use, this unit lends itself to diesel engines, air compressors, lubricating lines on motors, generators or reduction gears, small-diameter brine, steam or water lines, and many other applications. The one-piece construction eliminates separate front or top caps which might loosen under vibration. Sturdy glass front is held solidly in place by a string bezel, yet comes off easily when desired. Available with two separable socket connections, making it exceptionally easy to install and remove. Available in straight, angle, right-side angle, left-side angle, or oblique stems to afford best angle

Your voice can turn a corner through American Flexible Metal Tubing—200,000 Ediphones equipped with speaking tubes of flexible metal tubing are daily saving valuable time for busy executives. A typical everyday use for this versatile product.

To convey oil, steam, gas, water—

or a Voice!

You'll find a product of American Metal Hose to answer practically any requirement for flexible connections

Perhaps the most intriguing angle of flexible metal hose and tubing is its seemingly endless range of application—an unusual adaptability traceable to the variety of constructions in which we have made the product available. Using practically any workable metal, we can build flexible hose or tubing for anything from a simple oil can spout to a high pressure seamless hydraulic line that can be flexed millions of times without breaking—a line that will give you the flexibility of garden hose, the dependability of metal and the *strength of rigid pipe!*

Could it be that some type of this hose or tubing is the "missing link" you have been looking for? Whether you need a flexible connector for misaligned or moving parts, for isolating vibration, for conveying air, water, oil, steam or fuel, you'll likely find we have a type of flexible metal hose or tubing that will do the job more capably.

Practically all of our production is going to fill high priority orders, and our ability to deliver is of course limited accordingly . . . Meanwhile, do you have these fact-laden publications? 42186

ANACONDA
from mine to consumer

American Metal Hose

AMERICAN METAL HOSE BRANCH OF THE AMERICAN BRASS COMPANY • GENERAL OFFICES: WATERBURY, CONN.
Subsidiary of Anaconda Copper Mining Company • In Canada: ANACONDA AMERICAN BRASS LTD., *New Toronto, Ontario*

Selective Heating and Cooling
FOR ADJACENT WORK SPACES

CONSTANT air volume, combined with accurate temperature control! Work-spaces, and other rooms in war production plants—and in all industries—each have different temperature requirements. "Constant volume" systems of heating and ventilating—or air conditioning—with Johnson automatic control, allow adjacent areas to be heated or cooled to different temperatures.

Illustrated above, a double "trunk-duct" carries both warm and tempered air to a mixing chamber at each of the outlets. In some cases, warm air is supplied by one section of the duct and cool air by the other, allowing simultaneous heating or cooling of adjacent spaces. Johnson Control, at each outlet, consists of a *Gradual-Acting* Thermostat (A) controlling a *Long-Travel, Piston-Type* Damper Motor (B) which operates a pair of *Proportioning* Mixing Dampers (C). In the main "trunk-duct", Johnson Static Pressure Regulators control dampers to maintain automatically the proper resistance pressure.

This is another problem solved best by Johnson thermostats, with *adjustable sensitivity*, permitting the whole control system to be balanced precisely. Ask for descriptive bulletins or call a Johnson engineer.

★

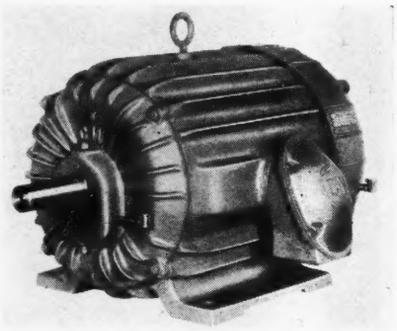
JOHNSON CONTROL SERVES WAR PRODUCTION PLANTS

For speedy, trouble-free War Production, machine parts must be measured with temperature-calibrated instruments. Curing rooms, test chambers, dryers, dipping tanks, kilns, vats, and coolers must be held at correct temperatures. That's why Johnson Control is on active duty in many War Production Plants.

JOHNSON
Automatic TEMPERATURE AND AIR CONDITIONING *Control*
JOHNSON SERVICE COMPANY, MILWAUKEE, WIS. & BRANCHES IN PRINCIPAL CITIES

Electric Motor

"COWL-COOLED" is the newest fan-cooled motor developed by company. Motor is designed for dusty locations and for all applications where conventional totally enclosed motor has been recommended. Because ventilating air is blown over external ribs which run the



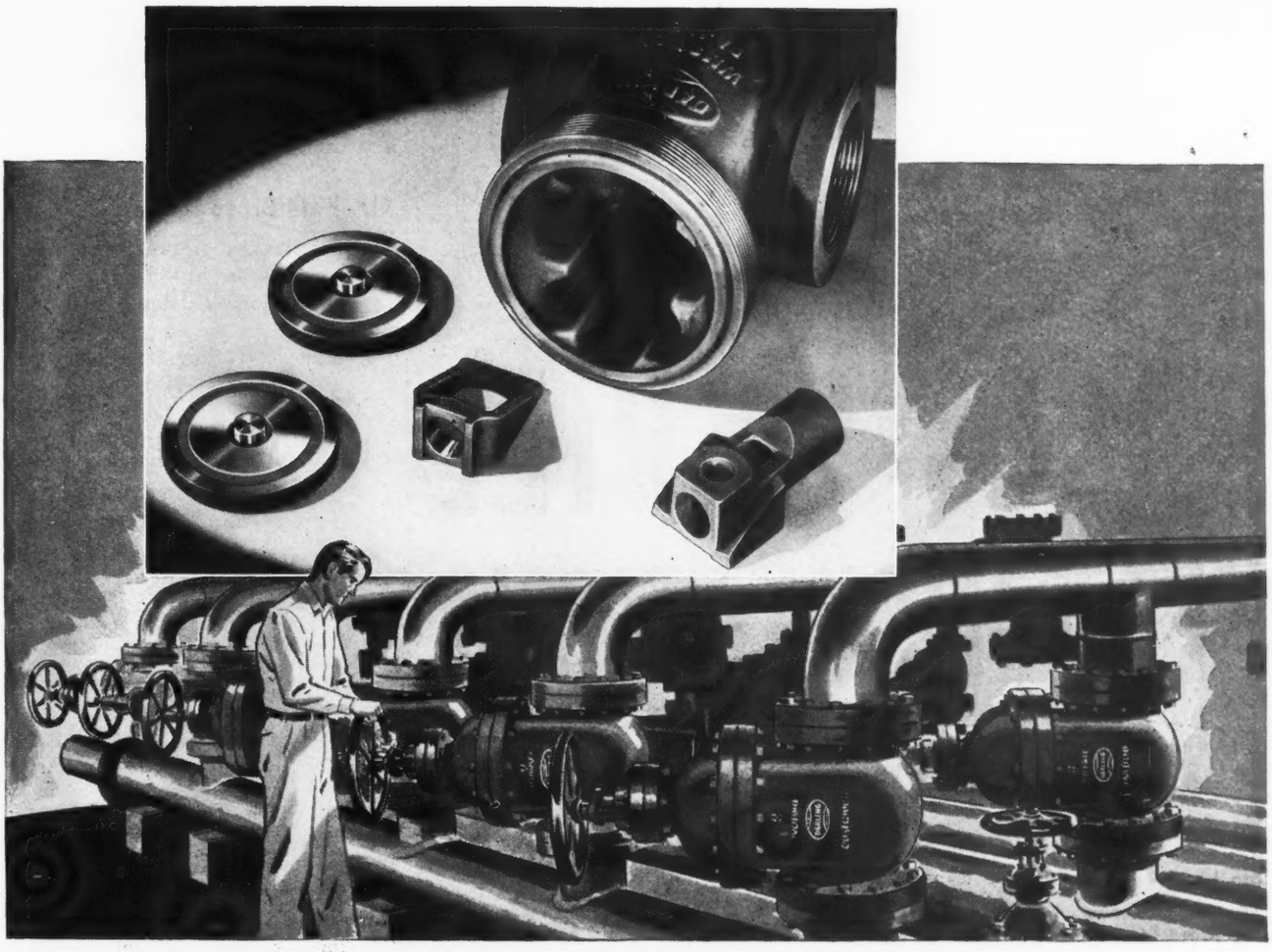
length of the frame and is not forced through internal passages, trouble-free operation is assured, even in atmospheres containing excessive amounts of destructive fumes, abrasive dust, oil or dirt. Motors are built in standard NEMA frame sizes up to 20 hp, either ball- or sleeve-bearing equipped. *Crocker-Wheeler Electric Mfg Co, Ampere, N. J.*

Standard Covers for Ball and Roller Bearings

WITH APPROVAL of all leading manufacturers of ball and roller bearings, standard covers in a complete range of types and sizes, have recently been developed for forming dust and grease-tight closures to bearing housing. Low unit cost in small or large quantities, saving of costly "nuisance" setups, reduction in designing, drafting, detailing and checking time as well as entire elimination of the costs of patterns, fixtures, gages, etc, are chief advantages. *R-S Products Corp, 4530 Germantown Ave, Philadelphia, Pa.*

Terminal Blocks

TERMINAL BLOCKS now supplied in kit forms or sets of parts unassembled. CDM-100 kit contains 50 center barriers and terminals while CDM-100 kit contains five sets of end barriers, mounting brackets, marking strip, threaded through rod and other necessary hardware. These terminal blocks are easy to assemble. Molded parts have a tensile strength of 4000 psi. Voltage breakdown at 60 cycles (50% relative hu-

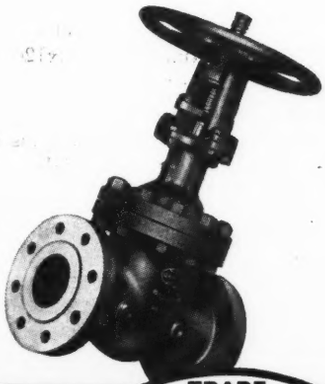


You write your own DARLING VALVE GUARANTEE

Here are the 4 reasons any Darling Valve will serve you better

● Longer life, better service for you are *designed into* Darling Valves with these 4 simple parts that have stood up under industry's toughest jobs for more than 40 years. The parallel discs are *fully revolving*—they never seat in exactly the same position in any two closings. That means wear is uniform and is distributed evenly over the entire surface of the discs. There is no other valve with this design. Darling gives you what you buy, a valve for *positive seating* over longer service. Men in the service departments of a dozen industries prefer Darling Valves because they last longer, cost less to maintain, cost *least* per gallon delivered per year of use.

We'll put the right Darling Valve in your toughest control point, and *you* write the guarantee. Call in the Darling Valve & Manufacturing Co., Williamsport, Pa.



Darling offers you a quality line of longer-lasting Gate Valves. They come in Fully Revolving Parallel Seat Double Disc, also in Taper Seat—Slotted and Solid Wedge types. In service pressures up to 3000 pounds, you can get Darling Gate Valves in Cast Iron, Bronze, Forged Steel, Cast Steel, and Corrosion Resistant Alloys. Darling also manufactures Compression Type Fire Hydrants, Check Valves, Motor and Cylinder Operated Valves, and many accessories.

TRADE DARLING MARK

VALVE & MANUFACTURING CO.

WILLIAMSPORT, PA.

Boost the Efficiency of Power Plant Equipment with

BALDWIN-HILL HEAT INSULATIONS

B-H MONO-BLOCK

Covers the full temperature range up to 1600° F. Equally effective at both high and low temperatures. Made in sizes up to 36" long, 24" wide, ½" to 4" thick. Chemically stable with low thermal conductivity. Easily cut and fitted to large areas.

B-H Black Rockwool BLANKET

Effective up to 1200° F. 7 styles using various types of metal fabrics. High heat and moisture resistance. Sizes 2' x 4' and 2' up to 8" thick. Easily handled and economical for application on large equipment.

B-H No. 100 PIPE COVERING

Effective up to 1200° F. Low alkalinity factor insures long life under severe heat and moisture conditions. Made in 2 ft. sections for pipe sizes from 2" to 30" in diameter.

B-H No. 1 INSULATING CEMENT

Effective up to 1800° F. Has rust inhibitor to prevent corrosion between insulation and metal surface. 100% reclaimable up to 1200° F. Easy to mix and apply. Bags contain 50 lbs. for easy storage.

NEW 16 page CATALOG

fully describes these and many other insulation products for temperatures ranging from —150° to 2000° F.

SEND FOR IT

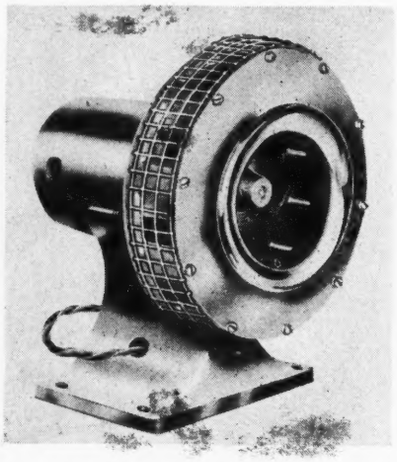
BALDWIN-HILL CO., 575 Klagg Ave., TRENTON, N. J.

NEW YORK CHICAGO KALAMAZOO, MICH.

midity) is approximately 375 volts per mil. All blocks assembled at the factory are subject to a 2500-volt flash test to ground. *Curtis Development & Mfg Co, 1 N Crawford Ave, Chicago, Ill.*

Air-Raid Siren

INSIDE-THE-PLANT air-raid sirens made in two models, one of which is for small departments, offices, laboratories, stock rooms, etc, and the other a large one for the manufacturing areas which can



be heard above the usual din of machines. Tornado sirens are equipped with Universal motors for either alternating or direct current, and are equipped with base for either vertical or horizontal mounting. *Breuer Electric Mfg Co, 5100 Ravenswood Ave, Chicago, Ill.*

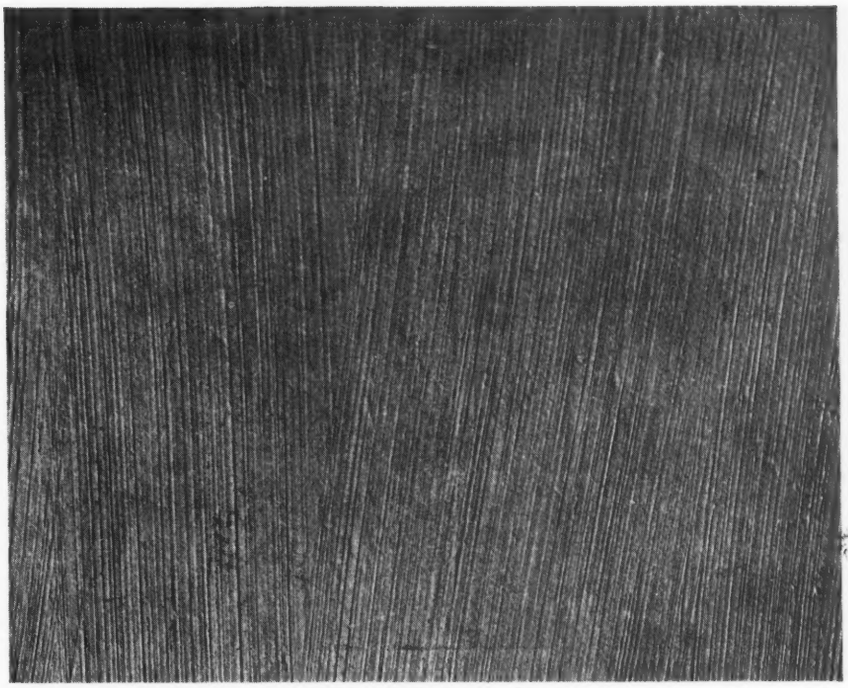
Synthetic Sponge

AMERIPOL SPONGE is made from Ameripol, an oil resisting and heat resisting synthetic rubber developed and perfected by the research laboratories of the B F Goodrich Co. Ameripol sponge is available in black only and in one density—medium. Sponge in slab form is now available in a minimum size of 20x20 in. and maximum size 20x120 in. ranging in thickness from 3/16 in. to ¼, ⅜, ½, ⅝ and ¾ in. Slabs can be supplied with "skin" on both sides or completely "skinless." These slabs may be used for any number of purposes, among which are the following: stamp cushions, packing, heel pads, ring gaskets, split gaskets, bushings, bumpers and vibration insulators. *B F Goodrich Co, Akron, Ohio.*

Colloidal Graphite

KONAG NATURAL COLLOIDAL GRAPHITE is available with lubricating oil, light fuel oil, diesel break-in oil, in grease and other applications. Konag Lube is furnished in 10% suspension. Konag A

Re-Surfaced Made Good as New



APEXIORIZED Boiler Metal

APEXIOR Protection Renews Old-Boiler Life

These days there's no argument about renewing all wearable materials for longer service. More so with steam boiler and turbine equipment — new installations don't come with a phone call. Your boiler metal positively must stand wear and tear for — who knows how long?

Old boilers — even those approaching the junk-heap — can be kept in indefinite service when protected with APEXIOR. Clean the metal down, and if the required hydrostatic pressure can be withstood, APEXIORIZE; and the equipment will be good for years of service.

APEXIOR — a Durable New Surface that Takes the Wear

APEXIOR No. 1, applied with a hand brush or power coater, adds an impervious top skin to boiler metal. This guardian "armor" resists wear, shuts out corrosion's penetration, prevents tight bonding of any scale that forms. Simple wire-brush cleaning removes the loosely adherent scale — with little down-time loss.

Easily renewed, an APEXIOR surface lasts up to three years or more.

APEXIOR guarantees good metal condition — no other protection offers the same assurance and security

As a supplementary protection with feedwater treatment, APEXIOR has been known and used for many years by power engineers who insist on peak efficiency and good housekeeping.

Now it means more than that — an *essential* in the serious business of prolonging and assuring efficient operation of old and new tubes and drums.

It will be worth dollars, time, production to you to investigate APEXIOR.

Write for Bulletin 1290

APEXIOR REG U.S. PAT. OFF.

Recommended by all U. S. and Canadian boiler companies

THE DAMPNEY COMPANY OF AMERICA

PROTECTIVE COATINGS FOR STATIONARY BOILERS, LOCOMOTIVES AND STEAMSHIPS

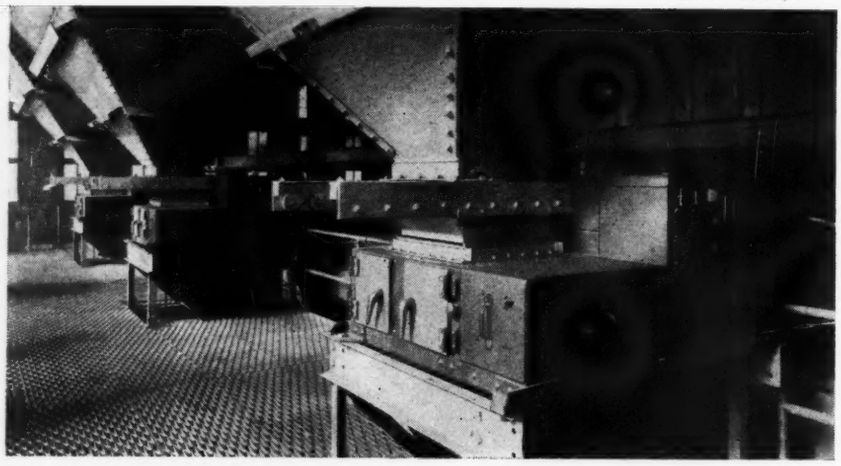
HYDE PARK · BOSTON · MASSACHUSETTS

Atlanta Chicago New York Detroit Philadelphia

Engineering Sales Representatives — Pittsburgh, Cincinnati, New Orleans, San Francisco, Los Angeles, Portland, Seattle, Phoenix, Denver, Salt Lake City, Dallas, Houston, Vancouver, B. C., Montreal, P. Q., Havana, Cuba, Manila, P. I., Honolulu, T. H., Marine Dept., 114 Liberty Street, New York, N. Y.

INCREASE OPERATING EFFICIENCIES AND CONSERVE COAL

Richardson Automatic Coal Scales automatically provide continuous records of coal consumed by each boiler — an essential step toward *saving coal*, lowering cost of power and *increasing evaporation.*



Richardson Automatic Coal Scales in use at the Red Star Yeast Plant, Milwaukee, Wisconsin

Now, more than ever before, you need accurate records of fuel consumption so as to avoid waste. If a boiler is evaporating say 9 lbs. of water instead of a possible 10 lbs of water per pound of coal, that's a 10% waste or loss. The continuous records provided by Richardson Coal Scales will show up such inefficiencies immediately and steps can be taken to correct such condition—hence the use of Richardson Automatic Coal Scale will enable you to produce

MORE STEAM FROM LESS COAL

Richardson Automatic Coal Scales are designed to give year in and year out dependable service at low maintenance cost—Machines are streamlined, dust-proof, and of welded construction, with easy access to all parts. Built to handle crushed coal—wet or dry—lumpy or slack—without interruption.

Bulletin 21240 gives complete technical data and illustrations of Richardson Scales, of standard and elongated models built to meet conditions in new and existing plants. Write for your copy today.

RICHARDSON

CHICAGO MINNEAPOLIS OMAHA WICHITA
SAN FRANCISCO ATLANTA BOSTON
NEW YORK PHILADELPHIA COLUMBUS

RICHARDSON SCALE COMPANY, CLIFTON, N. J.

2257

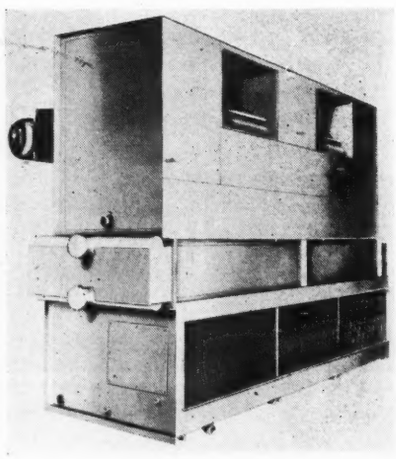
is a standard all-purpose lubricant and will be found satisfactory for blending with the great majority of lube oils and many greases. Konag B is 10% light fuel suspension designed for use by light fuel dealers who have facilities for doing their own blending. Konag C is a high concentrated natural collodial graphite suspended in diesel break-in oil. Said to save break-in time by producing a better "skin" more quickly. Konag D is natural collodial graphite suspended in Pennsylvania 660 steam refined to form a product which engineers find useful for blending in varying ratios with heavy oil and greases. *National Graphite Co Inc, 17 John St, New York, N. Y.*

Quenching-Oil Cooler

TRANE QUENCHING-OIL COOLER is recommended for industrial applications calling for the quenching process of hardening steel. This unit utilizes the atmospheric evaporative principle and is ordinarily applicable under the following conditions:

1. Where the use of large quantities of water is uneconomical,
2. Where water quantity is insufficient.
3. Where water temperature is too high.
4. Where it is not necessary to maintain quenching bath temperature below 100 F, and
5. Where water has corrosive properties, is excessively dirty, or has poor quality for other reasons.

Unit can be placed inside area or space in which quenching or cooling operation is conducted and can be suspended from the truss structure of the building if desirable, conserving valuable floor space. Other mechanical features include a rigid angle-iron framework with heavy-gage side sheets, a light weight, high-heat-transfer cleanable oil-cooling coil; ample-size squirrel-



Contrast the tidy, kitchen-clean OILBILT boiler room shown in the lower illustration which replaced the former ponderous, messy, costly-to-operate old H.R.T. boilers.

OILBILT INSTALLATION EXCEEDS EXPECTATIONS..

"Packaged" BOILER UNITS REDUCE COST APPROXIMATELY 40%

THESE excerpts from the report of Robert B. Witham, Administrator of The Leahi Home (Tuberculosis Hospital), Honolulu, Hawaii, after a year's experience with their OILBILT installation, is typical of many OILBILT performance reports:

". . . . a little over a year has elapsed since the original installation of our two 125 hp. OILBILT boilers . . . we have had full opportunity to observe their operation.

". . . I made a very careful and exhaustive examination — before reaching the decision to purchase them . . . analysis of the first year's log has more than borne out my original conclusion.

". . . these two boilers when placed in operation were installed on the line for continuous 24-hour operation — in contrast with the previous boilers — of the same hp. — operated from 12 to 14 hours per day — efficiency of OILBILT exceeded the recommendations of the manufacturer — cost of operation for a full 24-hour period day after day for the one year's log has been approximately 42% below that of the boilers they replaced — we have increased operating time approximately 35% — reduced operating cost approximately 40%.

". . . this type of boiler offers something not obtainable from any other method . . ."

Modern in every detail and embodying the best engineering practice and principles, OILBILT steam plants eliminate ashes, coal dust, smoke, a high expensive stack. Fuel costs are lowest because of OILBILT'S high thermal efficiency — they are specifically designed for efficient oil-firing with a long, four-pass, down draft boiler and integral burner. Built in sizes 20 to 500 hp.; pressures 15 to 200 lbs.

Write for bulletin.

Our "Victory" effort comes first. Greatly enlarged Cleaver-Brooks manufacturing facilities are going "around the clock" for military production.

CLEAVER-BROOKS COMPANY, 5109 N. 33rd St., Milwaukee, Wisconsin

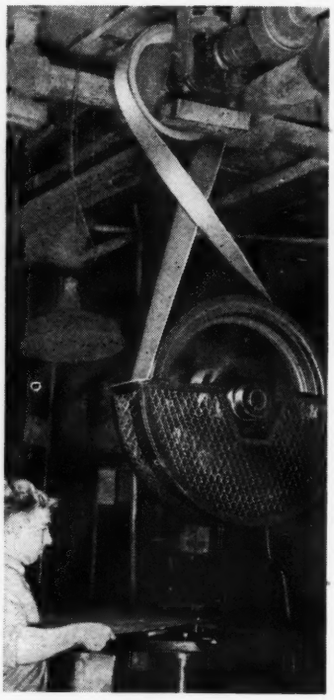
Oilbilt STEAM PLANTS

GET MORE OUTPUT

FROM NEW AND OLD MACHINES!

Keep present equipment operating at top efficiency and insure the best performance from new or revamped machines with Tannate flat leather belting.

Years of dependable service are built into every Tannate belt. Unusual strength (approximately 30% to 50% stronger than most choice oak belting) and firm pulley grip keep machines running smoothly at full capacity even under varying load conditions. High temperatures



BETTER SERVICE BELT HINTS
CHECK pulleys to make certain that they are in proper alignment and that pulley faces are smooth and not excessively crowned.
Install belting according to direction stamp on pulley side of belt.
Install at proper tension to transmit full load.
Keep belt fairly tight at all times. Proper tension keeps belts on pulley crowns and prevents the crocked-sense caused by belts running off the pulleys.
On stepped or flanged pulleys have the belt at least ¼" narrower than the pulleys.
Guard against oil, grease or cutting compounds getting on belting. If the belt becomes saturated with grease or oil, clean with gasoline or some similar material and then apply Rhoads Belt Preserver. Applications of Belt Preserver from time to time will keep the belt pliable and insure better transmitting capacity.
J. E. RHOADS AND SONS

(170° F. wet and 212° F wet) moisture, machine oil and many weak chemicals have little affect on Tannate. And Tannate will stay on the job 24 hours a day, seven days a week with little maintenance and infrequent shut downs.

FREE HELP
Our new folder "Better Service Belt Hints" tells how to keep belts on the job with A-1 efficiency. Put a copy in the hands of every one of your men concerned with belting. No obligation.

Let Tannate speak for itself with increased output, longer service-life, reduced costs. Why not give it a trial in your plant?

J. E. RHOADS & SONS
35 North 6th Street, Phila., Penna.
NEW YORK • CHICAGO • ATLANTA • CLEVELAND

STEP UP PRODUCTION with
RHOADS
Tannate
WATERSHED LEATHER BELTING
Established 1702

cage fans mounted on a heavy ground and polished steel shaft; a heavy-gage steel spray water tank and angle supports. Entire casing is given two coats of rust resisting paint before shipment. This method of oil cooling lends itself readily to automatic control, is simple to protect against freezing, and is practically foolproof in operation. Water consumption is negligible, and the temperature of local water supply is of no importance. A pump circulates oil from the quenching tank through the Trane quenching-oil cooler and back to the quenching tank. Any desired temperature not lower than 100 F can be maintained automatically. *The Trane Co, La Crosse, Wis.*

Load-Center Unit Substations

STANDARDIZED LOAD-CENTER unit substations are available in sizes ranging from 100 to 2000 kva. These compact, coordinated, factory-built units can be installed anywhere in industrial plants or power distribution centers, saving valuable headroom, floor space and long secondary runs of heavy copper. Substation consists of a metal-enclosed incoming-line section, throat-connected transformer and low-voltage feeder section. On the high-voltage side potheads, disconnect switches, oil-fuse cutouts, metal-clad switchgear or direct connection through terminal box can be supplied. On the low-voltage side, stationary or drawout air breakers, electrically or manually operated, are furnished. Standard load-center unit substations are available for either indoor or outdoor service. *Allis-Chalmers Mfg Co, Milwaukee, Wis.*

Cable Paint

No. 737 BLACK CABLE PAINT is oil and waterproof, extremely flexible and flame resistant one hour after application to cable. It is said to be also highly resistant to corrosive fumes and heat. For application to all cables such as power, control, motor leads, splices, etc, cable paint is supplied at heavy brushing consistency and provides a build up of eight mils per coat. *John C Dolph Co, Newark, N. J.*

Metal-Enclosed Switchgear Cases

250-VOLT DC AIR CIRCUIT breaker switchgear equipments for heavy duty available now in metal-enclosed cases. Latest development gives new safety features to the well-known MC-5 breaker, for-

For Victory
BUY U.S. WAR BONDS
Also for Victory — keep your plant going at full capacity. Avoid frequent shut-downs. Use packings, gaskets and oil seals which give long, dependable service.
THE GARLOCK PACKING COMPANY
PALMYRA, NEW YORK
In Canada: The Garlock Packing Company of Canada Limited, Montreal, Que.
GARLOCK
The Standard Packing of the World

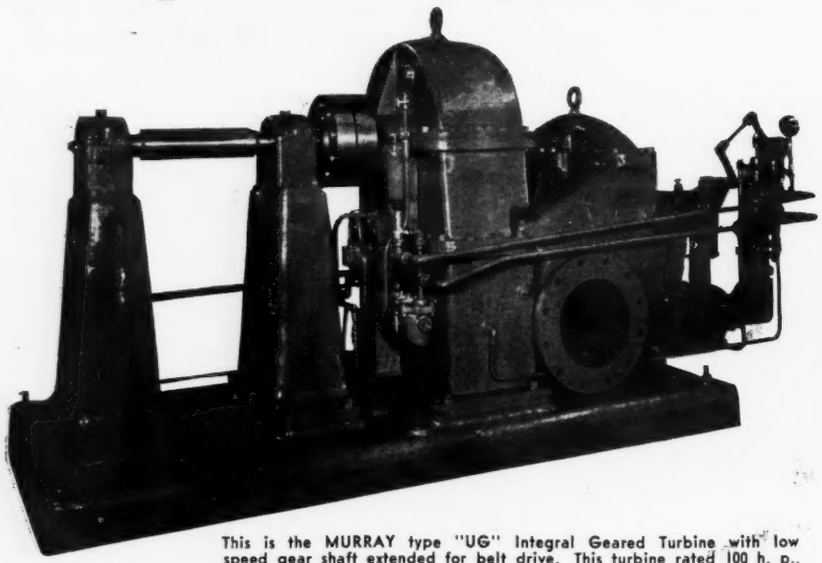
DON'T LET THE MATTER OF PRIORITY STOP YOU FROM PLANNING.....

For the Future

MURRAY TURBINES

WITH HIGH OVERALL EFFICIENCY

have proved exceptionally dependable in all production eras for 15 years...



This is the MURRAY type "UG" Integral Geared Turbine with low speed gear shaft extended for belt drive. This turbine rated 100 h. p., 2 00/400 r. p. m., operates at 160 lbs. initial pressure, D. & S. and 40 lbs. back pressure. This particular unit is in use driving a paper machine in a paper plant in Michigan.

•There are many types of MURRAY Turbines. The "UG" shown here is used to drive low speed machinery. There will be many of these machines to drive in the future as well as high speed machinery—power ever will be the basis of production.

With expanded production facilities, we are doing our utmost to make deliveries in accordance with priorities. You may not be one to get a MURRAY Turbine on priority, but you certainly will when victory comes to America. So, plan now for your turbine needs—let's talk it over—in the meantime why not send for MURRAY Bulletins so that you will have the details before you.

BOILERS TURBINES ENGINES

MURRAY IRON WORKS COMPANY

INCORPORATED 1870

BURLINGTON IOWA

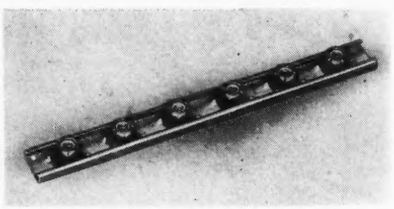
merly available only in "live-front" construction. Individual air circuit breakers are enclosed in separate steel compartments as are the control devices of the contactor. Control switches and instruments are mounted semiflush on the steel panels of the doors to control device compartments. Arc chutes specially designed to direct gases resulting from circuit interruption lead out from the top of the structure and away from the operating area. *General Electric Co, Schenectady, N. Y.*

Mechanical Seal

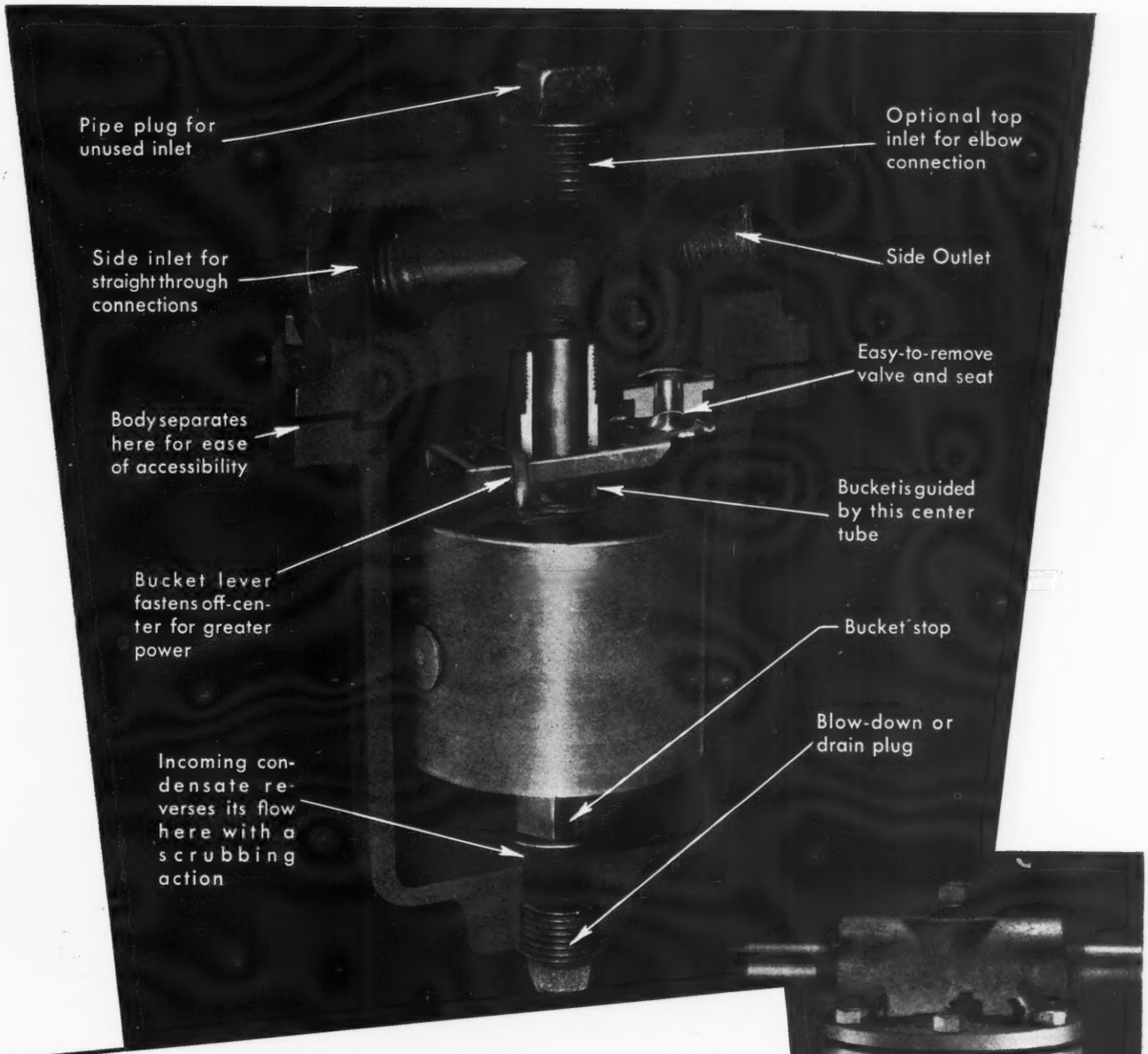
"SEALOL" is mechanical seal for rotating shafts with the initial sealing contact between the sealing ring and the hardened lapped face achieved by a light corrugated spring. Sealing against pressure is maintained by the fluid pressure itself acting on two opposing surfaces of different areas. Full fluid pressure acts against synthetic-rubber packing, thereby assuring a complete seal between the sealing ring and retainer cup. Assembly consists of only five parts, (1) pressed-steel retainer cup, (2) synthetic rubber packing, (3) flat thrust washer, (4) corrugated flat spring, and (5) sealing ring. *Stevenson Engineering Corp, 45 Willard Ave, Providence, R. I.*

Channel Nuts

ELASTIC STOP GANG channel nuts, widely applied in the aircraft industry, now offered for testing to general industry for application where a multiple, self-locking, bolted fastening is required. These strips of self-locking nuts have approval of military and civil air authorities and are used on all American-built military and transport aircraft. Strips are factory-assembled and it is



necessary only to rivet or otherwise fasten them to the structure where they are to be used. They consist of specially designed elastic stop nuts, with four lugs at the base, installed at specified intervals in a metal channel strip which is preformed to accommodate the nut lugs under longitudinal flanges. The channel strip is pierced for the required nut size and spacing, and the nuts are held in place by dimples in the channel, tolerances permitting them to be virtually self-centering. A nut


Pipe plug for unused inlet
Optional top inlet for elbow connection
Side inlet for straight through connections
Side Outlet
Easy-to-remove valve and seat
Body separates here for ease of accessibility
Bucket is guided by this center tube
Bucket lever fastens off-center for greater power
Bucket stop
Blow-down or drain plug
Incoming condensate reverses its flow here with a scrubbing action

LOOK INSIDE
THE SUPER-SILVERTOP

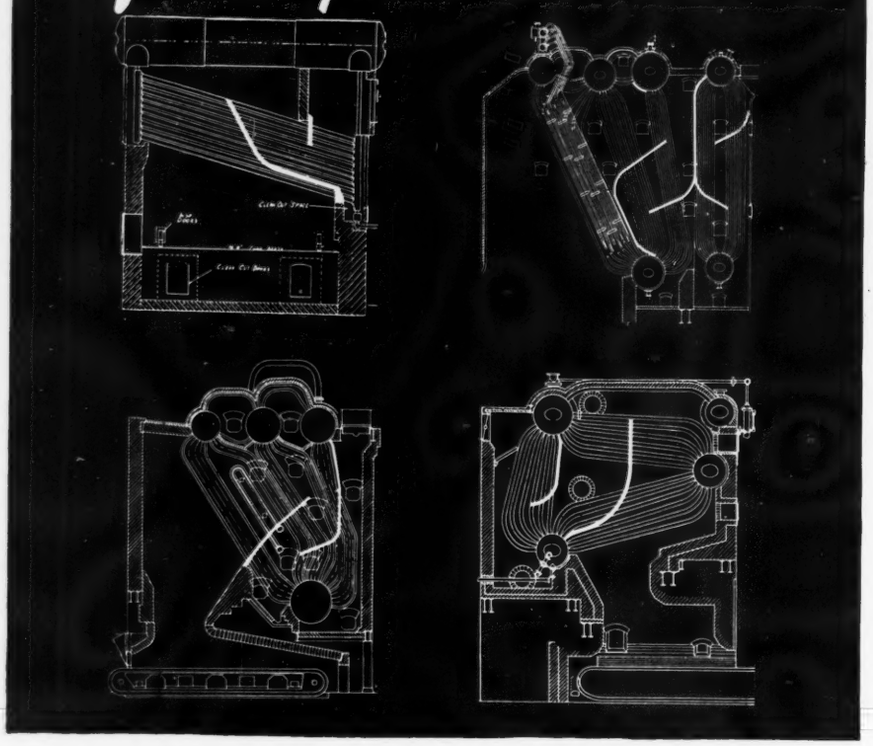
This inside view of Anderson Super-Silvertop steam trap shows why no outside U-tube is required. Also visible are features of Super-Silvertop not found in any other trap. Notice at "A," "D" and "C" that there are no rough cored passages to clog with dirt and scale.

Remember that Anderson Super-Silvertop is the trap that is easy to install or inspect—has higher than average condensate capacity—quickly removes all air and condensate from systems—has a long, trouble-free service life.

Send for your free copy of the helpful book—"How To Choose A Steam Trap"—it's worth having.

THE V. D. ANDERSON COMPANY
1934 WEST 96th STREET • • • CLEVELAND, OHIO

Get that EXTRA POWER from your BOILERS



PRESENT demands on steam generating plants are so heavy that the proper type, location, and construction of baffle walls are of the utmost importance. Enco Streamlined Baffles lower operating and maintenance costs—**but most important** they will increase the output of your boilers.

We would like to tell you more about Enco Streamlined Baffles — why their installation will result in increased capacity and all-around operating efficiency.

Write for Bulletin BW 40 or, for quick action, send blue prints and operating data. There is no obligation.

THE ENGINEER COMPANY
75 WEST STREET • NEW YORK, N. Y.

Enco Streamline Baffles
PRODUCED EXCLUSIVELY BY THE ENGINEER COMPANY

can be easily removed from channel by inserting a thin screwdriver between flange and nut and drawing it sharply toward the flange. New nuts can also be replaced on the channel without removing it from its permanent attachment to the structure or disturbing the remaining nuts in the unit. *Elastic Stop Nut Corp, 2332 Vauxhall Road, Union. N. J.*

Insulating Varnish

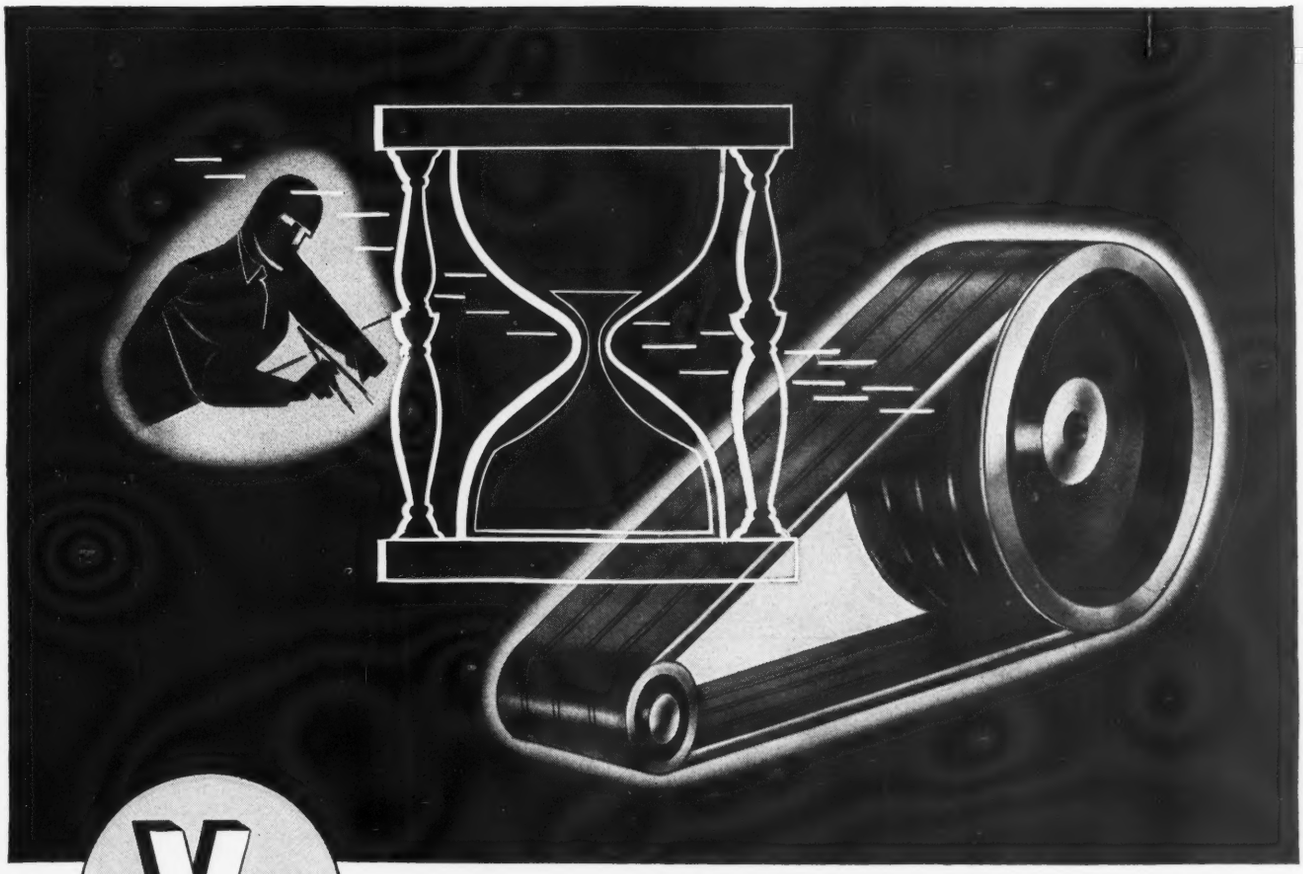
THERMOSET is synthetic-resin insulating varnish cured by heat-induced chemical polymerization. It sets to an infusable flexible inert film of clear amber color and has high dielectric and bonding strength. Of low viscosity, varnish will not skin over or gum up equipment with an insoluble film and penetrates the deepest windings to fill interior voids completely. Thermoset is not affected by acids or alkalis in ordinary concentrations. When cured, material protects enamel coating on magnet wire, will not corrode uncoated metals, and guards against rust, according to maker. *Westinghouse Electric & Mfg Co, East Pittsburgh, Pa.*

Slot Insulations

IRV-O-SLOT INSULATION consists of Fish or Spauldo papers coated with resin, or bonded by means of a plastic insulator, to cambric, silk or Fiberglas. These insulations possess ample strength and toughness as protection against mechanical stresses. They have high dielectric strength. Bonded insulations have high moisture resistance. Available in sheets and also tape form ready to be cut into slot strips. *Irvington Varnish & Insulator Co, Irvington, N. J.*

Sectional Resistor

FOR USE IN RAILWAY SERVICE, radio circuits, power rectifiers and laboratories, for measuring any high voltage ac or dc circuit of 250 to 30,000 volts, new sectional resistor is designed to replace in certain cases old box-type resistor which had a high power consumption and was inconvient to install or replace. Made up of individual, hermetically sealed units wire wound around a ceramic resistor spool, the resistor units have values of from 0.25 to one megohm and a rated current of one milliampere. Dimensions are $1\frac{3}{8}$ in. by $1\frac{1}{4}$ in. in diameter per section. Ceramic resistor spool is sectionalized, and adjacent sections are wound in opposite directions to obtain a non-inductive resistance. *Westinghouse Electric & Mfg Co, East Pittsburgh, Pa.*



MULTIPLE V-BELT DRIVE ASS'N

THE DOMINANT DRIVE OF INDUSTRY

TRADE MARK

The use of this emblem by an association member in connection with Multiple V-Belt Drives is your assurance of mechanical excellence — the result of cooperative engineering, research and experience.

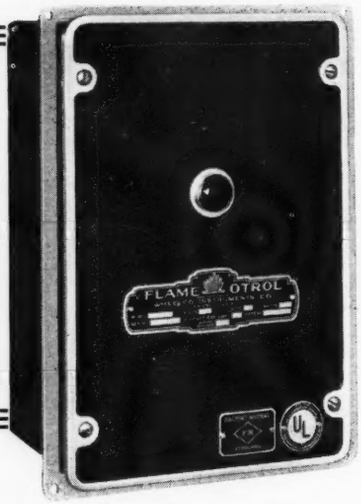
backed by over a century's combined experience . . . .

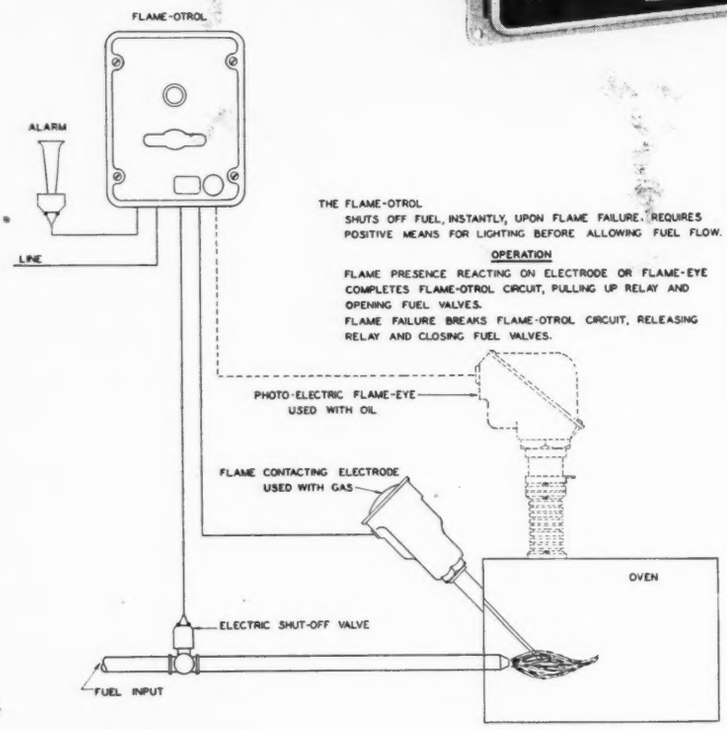
Although the first commercial Multiple V-Belt installation was made only 17 years ago, the aggregate experience responsible for the amazing rise to popularity of "The Dominant Drive of Industry" is well over a hundred years. It represents the combined experience of all association members. . . . By working independently, yet pooling the results of laboratory research and field reports, a vast fund of information was available to all. In no other way could such swift and substantial progress in developing for industry a power drive, which by its sheer superiority, has ushered into the power transmission world a new era in the art. . . . And every year, adds more to research, and continuous effort to further increase efficiency.

MULTIPLE-V-BELT DRIVE ASSOCIATION
140 SOUTH DEARBORN STREET • CHICAGO

YOU CAN PREVENT COMBUSTION EXPLOSIONS

regardless of fuel burned




FLAME-OTROL
ALARM
LINE
THE FLAME-OTROL
SHUTS OFF FUEL, INSTANTLY, UPON FLAME FAILURE. REQUIRES POSITIVE MEANS FOR LIGHTING BEFORE ALLOWING FUEL FLOW.
OPERATION
FLAME PRESENCE REACTING ON ELECTRODE OR FLAME-EYE COMPLETES FLAME-OTROL CIRCUIT, PULLING UP RELAY AND OPENING FUEL VALVES.
FLAME FAILURE BREAKS FLAME-OTROL CIRCUIT, RELEASING RELAY AND CLOSING FUEL VALVES.
PHOTO-ELECTRIC FLAME-EYE USED WITH OIL
FLAME CONTACTING ELECTRODE USED WITH GAS
OVEN
ELECTRIC SHUT-OFF VALVE
FUEL INPUT

The Wheelco FLAME-OTROL

—provides instantaneous shut-off of fuel supply in case of flame failure. It is the only combustion safeguard approved by both the Underwriters' Laboratories and the Associated Factory Mutual Laboratories for all types of fuel. The FLAME-OTROL is available with automatic or manual ignition, time delay for purging, or any other sequence of operation desired.

Bulletin L2 gives complete information. Reguest your FREE copy TODAY!

Wheelco Instruments Co.

863 HARRISON STREET **CHICAGO, ILLINOIS**

New Bulletins

BOILERS AND ACCESSORIES

1 TUBE CLEANERS—Thomas C. Wilson, Inc, 47-28 37th Street, Long Island City, N. Y. Catalog No. 42, 36 pages, describes Wilson tube cleaners operated by air, steam, water and electricity for cleaning tubes of all kinds in which scale, carbon, rust or sludge form.

2 UNIT PULVERIZER—Sims Co, Erie, Pa. New booklet includes the history and development of pulverized coal, a detailed discussion on burning pulverized coal, complete description of pulverizer and burner, performance data on service and savings, and numerous application drawings.

3 GAS BURNERS — Peabody Engineering Corp, 580 Fifth Avenue, New York, N. Y. Bulletin No. 203, 4 pages, features Peabody combined gas and oil burners in types A and H, available in a full range of sizes with individual burner capacities up to approximately 100,000,000 Btu per hour.

4 BOILER LININGS—Ramtite Co, 2549 West 18th Street, Chicago, Ill. 16-page bulletin entitled, 'The Better Method of Setting and Lining Return Tubular Boilers" explains improvements in setting and relining boilers as well as a discussion of engineering properties of Ramtite plastic refractories.

5 BOILER OPERATION—Bailey Meter Co, Cleveland, Ohio. 20-page bulletin No. 16, entitled "How to Safely Stretch Steaming Capacity," explains how proper use of metering and control equipment stretches capacity, avoids shutdowns, insures safety, furnishes data for fuel comparison, reduces fuel consumption, and maintains efficiency while new operators are trained.

6 WATER COLUMNS — Yarnall-Waring Co, Chestnut Hill, Philadelphia, Pa. 20-page revised bulletin WG-1809 illustrates construction details of Yarway water columns, try-cocks and water-level gages with photographs and diagrams. Other features include a table of dimensions and prices, a spare or repair parts list and typical installation photographs.

ELECTRICAL EQUIPMENT

7 TRANSFORMERS — United Transformer Co, 150 Varick St. New York, N. Y. Bulletin No. PS-405, 36 pages, presents complete line of transformers for broadcast, amateur, laboratory and replacement purposes. Photographs, diagrams, charts and tables describe specific transformers.

8 OIL CIRCUIT BREAKERS — Roller-Smith Co, Bethlehem, Pa. 12-page catalog 3130 describes small oil circuit breakers designed for ac circuits in industrial plants and power houses. Also discusses various methods of tripping, describes attachments that can be supplied, gives characteristics of each size breaker and shows dimensions and typical control diagrams.

HEATING, AIR CONDITIONING & REFRIGERATION

9 QUENCH-OIL COOLER — The Trane Co, La Crosse, Wis. 4-page Bulletin S363 covers four basic systems for cooling quenching oil: evaporative cooler, shell-and-tube heat exchanger, mechanical refrigeration, and combination systems, each of which is diagramed.

10 AIR CONDITIONERS—Air and Refrigeration Corp, 475 Fifth Avenue, New York, N. Y. 24-page bulletin G-2 describes the capillary cell and its application in air conditioning equipment as direct heat-transfer surface between water and air. Outlines functions of cells for cooling and dehumidifying, evaporative cooling, condenser water cooling etc, and draws attention to fact that copper coils are not essential.

NEW CATALOGS, BOOKLETS, BULLETINS

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For Your Convenience

Two business-reply cards are printed here as a part of this insert. On each is room for you to request four pieces of literature.

How to Order

1. If you are requesting four pieces or less, please use only the bottom card. Likewise, for four to eight pieces, use both attached cards.

2. Be sure to fill one of the eight spaces for each piece you order. This will assure your receiving copies of literature promptly by reducing amount of clerical work in handling your request.

3. When you have filled out one space for each catalog or bulletin you want, detach along the scored lines and drop the cards in the mail. No postage is required.

Example

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Address 110 WEST 70TH ST.
NEW YORK, N.Y.
Company WM. DOE MFG. CO.
Title POWER ENGINEER
POWER, 330 West 42nd St, New York 4/42

These cards not good after August 1, 1942

11 COMPRESSORS—Worthington Pump and Machinery Corp, Harrison, N. J. 28-page bulletin No. L-675-B1 features Worthington feather valve compressors, 75 to 3000 hp, horizontal duplex, motor-driven, direct-connected and belted. Photographs and cross-sectional diagrams illustrate characteristics, application and maintenance of these machines.

12 AIR COMPRESSORS—Schramm Inc, West Chester, Pa. Catalog 42-S, 12 pages, presents the standard Schramm stationary compressors for heavy-duty, continuous service with minimum attention. Photographs, diagrams, tables of specifications, and brief descriptions furnished.

13 HEATING—Induction Heating Corp, 389 Lafayette St, New York, N. Y. Data sheet entitled, "Fundamentals of Induction Heating" is first in a series which will make up course in the fundamentals and applications of induction heating. Sheet No. 1 covers elemental theory.

LUBRICATION

14 LUBRICANTS — Master Lubricants Co, Meadow and Jackson Sts, Philadelphia, Pa. 6-page pocket-size folder discusses Lubriko grease, said to have high melting point and low cold test. Lubricant is available in 14 grades for ball and roller bearing lubrication and for general-purpose sleeve bearing lubrication.

15 LUBRICATING EQUIPMENT—Gray Co, Inc, Minneapolis, Minn. 20-page book discusses Graco industrial lubricating equipment for heavy-duty service for fleet, contractor, factory, airport, railroad and industrial use. Lubricant pumps hand guns, hose, meters and accessories described and illustrated.

16 INDUSTRIAL OILS — Honan-Crane Corp, Lebanon, Ind. Bulletin No. 54 discusses the application of oil purification to industrial oils which include cutting oil, insulating oil, roller backup bearing oils, hydraulic oils, honing oils, compressor and fuel oils.

MATERIALS HANDLING

17 MATERIALS HANDLING—Barrett-Cravens Co, 3255 W 30th St, Chicago, Ill. Catalog No. 501, 160 pages contains over 400 illustrations of materials handling equipment including lift-trucks and skids, portable elevators and cranes, barrel and drum storage racks and two- and four-wheel trucks. All described and specified.

18 ELECTRIC HOIST—Wright Mfg Division, American Chain and Cable Co, Inc, York, Pa. 12-page booklet explains Wright "Speedway" hoist, which is low-cost electric hoist designed for fast lifting in machine shops, assembly floors.

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Photographs, cross-sectional diagrams, charts and tables of prices and specifications also furnished.

MECHANICAL TRANSMISSION

19 STEEL BALLS FOR BEARINGS—Atlas Ball Div, SKF Industries, Inc, Front St and Erie Ave, Philadelphia, Pa. 8-page catalog describes method used in making balls round. Ten steps are necessary before a steel ball is made round; they are: pressing, flashing, rough grinding, multiple-groove grinding, tumbling, heat treating, precision grinding, lapping, inspection and gaging. Each step fully illustrated.

METERS, INSTRUMENTS & CONTROLS

20 TEMPERATURE REGULATORS—Sarco Co, Inc, 475 Fifth Avenue, New York, N. Y. Bulletin No. 600, 16 pages, covers Sarco self-operated temperature regulator for water heaters and industrial applications. Gives specifications, dimensions, list prices and shipping weights of each regulator described.

21 TACHOMETER—Herman H Sticht Co, Inc, 27 Park Place, New York, N. Y. Describes model J centrifugal hand tachometer whose operating mechanism is entirely on ball and oiless bearings. A wheel disk for reading surface speeds directly in fpm comes with instrument.

22 INSTRUMENTS—Taylor Instrument Co's, Rochester, N. Y. Catalog No. 76 JF, 24 pages, lists the bourdon spring, bellows and manometer instruments for indicating, recording and controlling pressures. Also contains information on gage, differential and absolute pressure and vacuums.

23 GAGES—Brown Instrument Co, Philadelphia, Pa. Bulletin No. 70-11 contains specifications of Brown absolute pressure gage with forms and models available, and gives advantages and outstanding features of instrument through exterior and interior-view photographs.

24 OIL-BURNING SYSTEM—Peabody Engineering Corp, 580 Fifth Ave, New York, N. Y. 4-page bulletin No. 107 presents the cd (constant differential) system of control for mechanical atomizers with diagrams and application photographs.

25 CONTROLS—The Hotstream Heater Co, 8007 Grand Avenue, Cleveland, Ohio. 4-page folder covers Hotsteam line of combustion controls, damper regulators, and modulating controls for increasing efficiency in steam generation.

26 SPEED INDICATOR—Reeves Pulley Co, Columbus, Ind. 4-page bulletin No. G-427 features new electric remote-speed indicator for use with Reeves variable speed control equipment. Typical installation photographs show several methods of mounting these instruments.

27 TACHOMETER—James G Biddle Co, 1211-13 Arch St, Philadelphia, Pa. 4-page folder, bulletin 1710, describes Jones heavy-duty hand tachometer for measuring speed directly in rpm or fpm. Instrument is made in both single and triple-range models for speeds from 200 to 2000 rpm.

28 CO_2 INDICATOR—Bacharach Industrial Instrument Co, 7000 Bennett St, Pittsburgh, Pa. Bulletin 337 discusses Fyrite CO_2 indicator which permits analysis in 30 seconds, is spillproof in any position and is also cold-weather proof. Also includes comments of typical users.

29 PRESSURE RECORDER—Foxboro Co, Foxboro, Mass. 32-page catalog 22-A describes instruments for measuring and recording all industrial pressures, in ranges from 1 in. water to 20,000 psi. Also contains list of standard ranges with full-size reproductions of specimen charts. Other sections cover methods of instrument mounting, cases available, integral electric signal systems, and necessary equipment.

30 CONTROLS—J A Campbell Co, 651 Wardlow Road, Long Beach, Cal. Bulletin presents two boiler feedwater-level controllers—pilot-operated and rotary. Also describes other recently introduced products including Campbell Micro-Bean, stainless steel thermometer wells, gas samplers, and feet gage strips.

31 SMOKE RECORDING EQUIPMENT—Leeds & Northrup Co, 4934 Stenton Avenue, Philadelphia, Pa. Catalog N-93-163, 16 pages, illustrated with many installation pictures, tells how operators can tell smoke trend by referring to a chart on which smoke density is recorded. Also points out that signal lamps can be used to flash warning when stack smokes excessively.

32 FLOW INDICATORS—S F Bowser & Co Inc, Fort Wayne, Indiana. 8-page circular entitled "Flow Indicating Devices" shows what goes on in the pipeline. Shows devices for clear or opaque liquids, for vertical or horizontal installations, in adjustable or non-adjustable flow types with photographs, diagrams and specifications.

33 TEMPERATURE CONTROL SYSTEMS—Automatic Temperature Control Co, Inc, 34 East Logan St, Philadelphia, Pa. 12-page catalog A14, shows full line of electric motor valve operators as applied to standard temperature control systems for fuel-fired furnaces. Tabulated data and wiring diagrams are also provided.

MOTORS

34 MOTOR-GENERATOR UNITS—Kato Engineering Co, Mankato, Minn. Form 1241 features Katolight plants in 7500, 10,000, and 15,000; 1200 and 1800 rpm which can be furnished either self-excited or with separate exciter attached. Also furnishes cross-sectional diagram, photograph and specification table.

PIPING, VALVES AND FITTINGS

35 VALVES—Everlasting Valve Co, 49 Fisk St, Jersey City, N. J. Bulletin E-52 B, 4 pages, covers weight-operated Everlasting valves with pendulum stop for fire protection. Illustrations show both opening and closing types with specifications.

36 EXPANSION JOINTS—Joseph Kopperman & Sons, 312-16 New St, Philadelphia, Pa. Catalog No. 61, 16 pages, outlines Kopperman packless copper expansion joints with mechanical and technical data on installations. Also lists many features not previously available in a packless expansion joint.

37 UNDERGROUND STEAM SYSTEMS—Ric-wil Co, Cleveland, Ohio. Spiral-bound Bulletin No. 420-A, furnishes engineering data on underground steam systems for defense needs, compiled from field experience. Some adaptations of Ric-wil insulated pipe units to solve wartime problems are shown in many typical layouts and specifications. Tables of engineering information, charts, graphs, and installation diagrams included.

(Continued on page 172)

FIRST CLASS
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(Sec.510,P.L.&R.)
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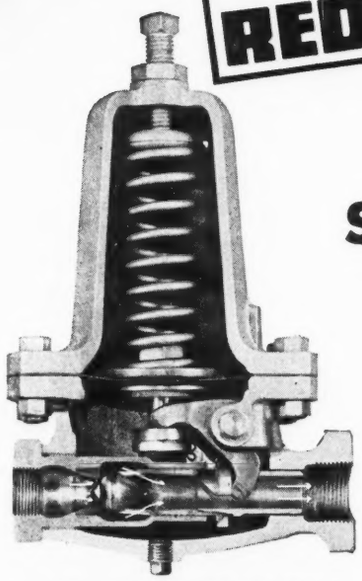
Eliminating

LOST PRODUCTION HOURS DUE TO "TIME OUT" FOR VALVE TROUBLES . . .

CASH STANDARD *Streamlined* TYPE 1000 PRESSURE REDUCING VALVE



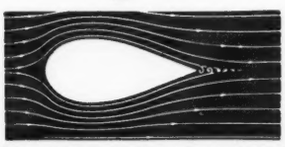
Contributes toward SPEEDIER PRODUCTION

Today, with speed in output the keynote of American Industry, trouble-free, smooth performance of equipment is essential to maintain schedules. Keeping idle hours down to the very minimum is a vital need in any type of production.

Because of these very things, the CASH STANDARD Streamlined Type 1000 Reducing Valve has a place of importance in industry's fast-operating set-up . . . it is an immediate answer to the practical elimination of "time-out" periods.

When this valve was first designed, 'round-the-clock service — month in and month out was the objective. How well the Streamlined Type 1000 fits into the pace-setting production picture now is seen by its no-trouble, maintenance-free operation for years past.

Among the benefits users get with it are: maximum capacity when needed most — accurate pressure control under toughest working conditions — elimination of failures — cost-saving operation.



HERE'S THE "1000" FLOW PATTERN
The Streamlined form of the inner valve eliminates turbulence. It produces the flow pattern shown above which makes for maximum capacity when it is needed most and permits accurate pressure control under toughest working conditions.

You can find out full details on all of the Type 1000 benefits by reading Bulletin "1000" —send for it!

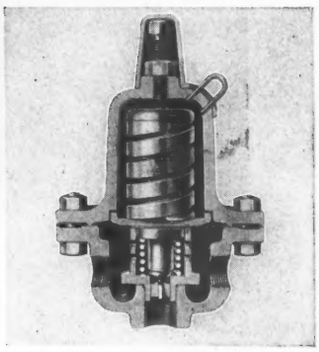
A. W. CASH COMPANY
DECATUR, ILLINOIS

CASH STANDARD CONTROLS.. VALVES

A CASH STANDARD "GET ACQUAINTED" COLUMN

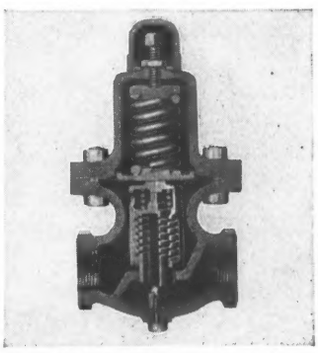
Question: **"Don't you people make anything besides that Streamlined Valve you talk about so much?"**

Answer: **"Yes Sir; we do! And we propose to picture one or two of them here each time."**



Cash Standard Type Q Relief Valve; maintains constant upstream pressure by relieving into lower downstream pressures, regardless of variations in downstream pressure. For steam, water, air, oil, many gases. (Similar valve for refrigeration fluids.)

Iron or bronze bodies; bronze trim; pressures up to 350 lbs.; top temperature 500° F. Screwed ends; sizes ¼" to 2".



Cash Standard Type 4190 Valve; holds constant back pressure on inlet side regardless of variation in outlet pressure or changes in load. A multiport, large capacity valve. Used on suction line in refrigeration practice. Also used extensively as bypass valve for oil pumps.

Iron or bronze bodies; iron trim. Screwed ends ½" to 2"; flanged ends 1¼" to 6".

☆

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A. W. CASH COMPANY
DECATUR, ILL.

*P.M. is for *Preventive Maintenance*, a term which aptly covers the periodic use of "MEGGER" Testers for checking the condition of insulation in generators, wiring, motors and other electrical equipment. Incipient insulation troubles are thereby detected and isolated . . . and corrective measures can be taken *before* major failures occur. As a consequence, damage or destruction of valuable equipment is prevented and priceless production time is saved. Preventive Maintenance is obviously more practical than permitting insulation to break down—and then hold a Post Mortem to determine the cause.

If you are already familiar with the "MEGGER" Testers and what they do, you most likely have one in your plant. Plan to use it systematically. It is your ounce of prevention against costly electrical breakdowns.

Do you have our Pocket Manual of "MEGGER" Practice? If not, write for a free copy of Manual No. 1420-P.

JAMES G. BIDDLE CO.
1211-13 ARCH ST. • PHILADELPHIA, PA.

"MEGGER"
TRADE MARK REGISTERED U.S. PAT. OFF.
Insulation Testers, Ground Testers and Ohmmeters

New Bulletins

(*Continued from page* 170)

38 VALVES — Frick Co, Waynesboro, Pa. 6-page folder, bulletin No. 191-A features Frick semi-steel valves and fittings for use with ammonia, Freon-12, methyl chloride, carbon dioxide, or other gases and liquids at normal or low temperatures. Photographs and diagrams illustrate these valves.

39 CONSERVATION FOLDERS—Manning, Maxwell & Moore, Inc, Bridgeport, Conn. Series of instruction pamphlets show how to make equipment last longer. Among the titles already issued are, "How To Make Your Thermometers Last Longer" and "How To Make Your Safety and Relief Valves Last Longer". Suggestions will be helpful even on competitive products.

40 VALVES—J S Coffin Jr, Co, Englewood, N. J. 4-page bulletin CV-1 outlines the Coffin control valve for regulation of boiler feed with line and cross-sectional diagrams. Typical application sketch included.

PUMPS

41 PUMPS—Higgins Industries, Inc, 521 City Park Avenue, New Orleans, La. 4-page folder announces Higgins turbine pump now available to industry after application on company's boats. Table of capacities at various heads and hp, photograph of pump, and other engineering data included.

42 PUMPS—Blackmer Pump Co, Grand Rapids, Mich. 4-page folder features Blackmer direct-connected rotary pump with capacities of 5-10-20-gpm, furnished in all standard drives for many uses. Principle of operation and important mechanical features described and illustrated. Also includes tables of specifications.

43 PUMPS — Worthington Pump and Machinery Corp, Harrison, N. J. 8-page bulletin W-350-B6 outlines Worthite pumps for handling hot brine slurries and oil-field brines. Worthite is high-alloy-complex steel recommended for this particular application.

44 PUMPS — Allis-Chalmers Mfg Co, Milwaukee, Wis. 36-page bulletin, B6018-B, furnishes engineering data on Electrifugal and SSUnit pumps. Contains head capacity and dimension charts for selection of proper pumps for individual applications and many photographs and diagrams illustrating complete pump line.

45 PUMPS—Ingersoll-Rand Co, Phillipsburg, N. J. 12-page 2-color bulletin contains photographs and cross-sectional views, extensive performance tables, of class GT 2-stage centrifugal pumps and tabulation showing friction of water in various sizes of pipe. Many practical applications cited.

WATER TREATMENT

46 FEEDWATER TREATMENT — The Bird-Archer Co, 400 Madison Ave, New York, N. Y. 4-page folder introduces Tanalginate, new protective and reactive colloidal material for conditioning boiler feedwater. Product is used in conjunction with such inorganic chemicals as phosphates or alkali.

47 WATER TREATMENT—W A Taylor & Co, 7300 York Road, Baltimore, Md. Fifth edition of booklet entitled "Modern pH and Chlorine Control" discusses the meaning of pH control, methods, theory, applications and brief descriptions of company's line of equipment. Insert lists new prices effective January 1, 1942.

48 WATER TESTING—The Bird-Archer Co, 400 Madison Ave, New York, N. Y. 20-page booklet contains concise information on water-testing equipment, method of making all control tests, conductivity apparatus, proportioning pumps, and chemical feeders.

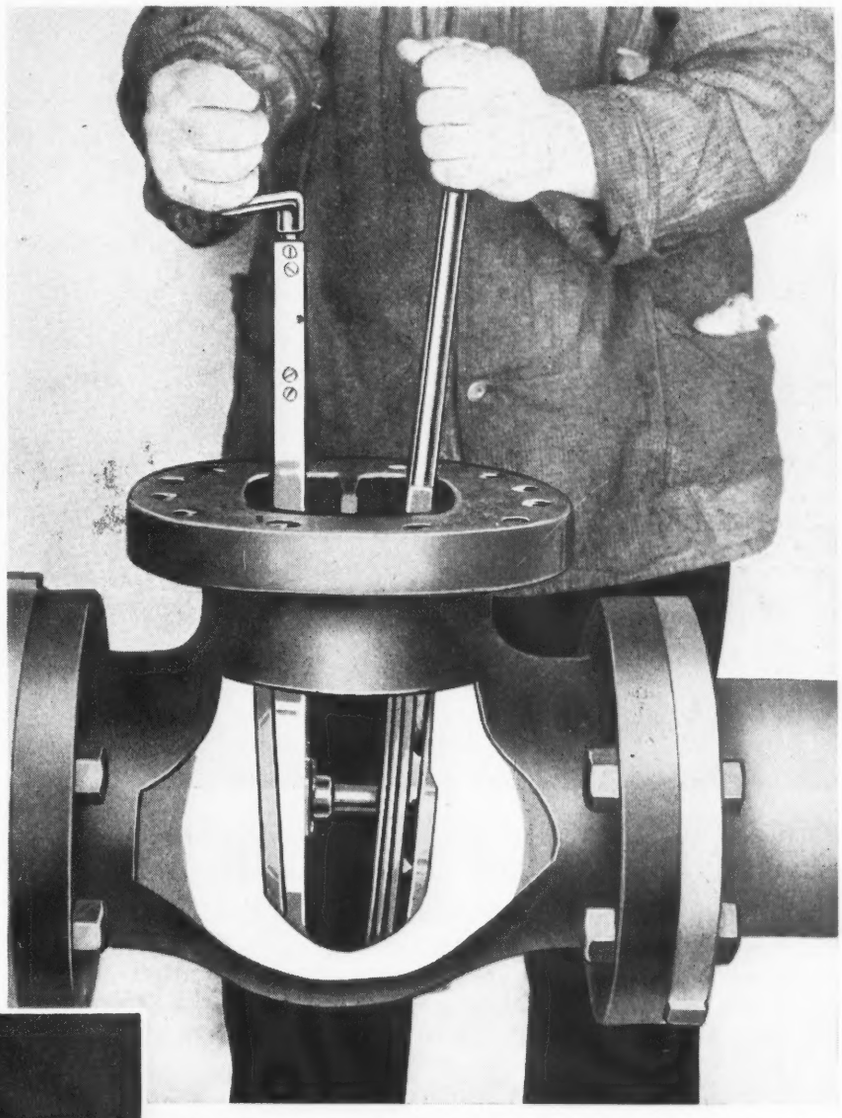
Reseat Without Removing the VALVE From the Line

Any mechanic using Dexter Equipment can reseat a valve (gate, globe or pump) in position,—can do it in an hour or less and make the seat and gate or disc, pressure tight.

Cutters are available for monel, stainless steel and stellite as well as brass and bronze.

Put an end to leaky valves in the line and salvage your old ones from your scrap pile. Dexter Equipment quickly pays for itself. Order today.

Capacities: Globe valves, ¼" to 14"; Gate valves, 1½" to 48"; Pump valves, 1½" to 15".



Dexter Valve Reseating Machines

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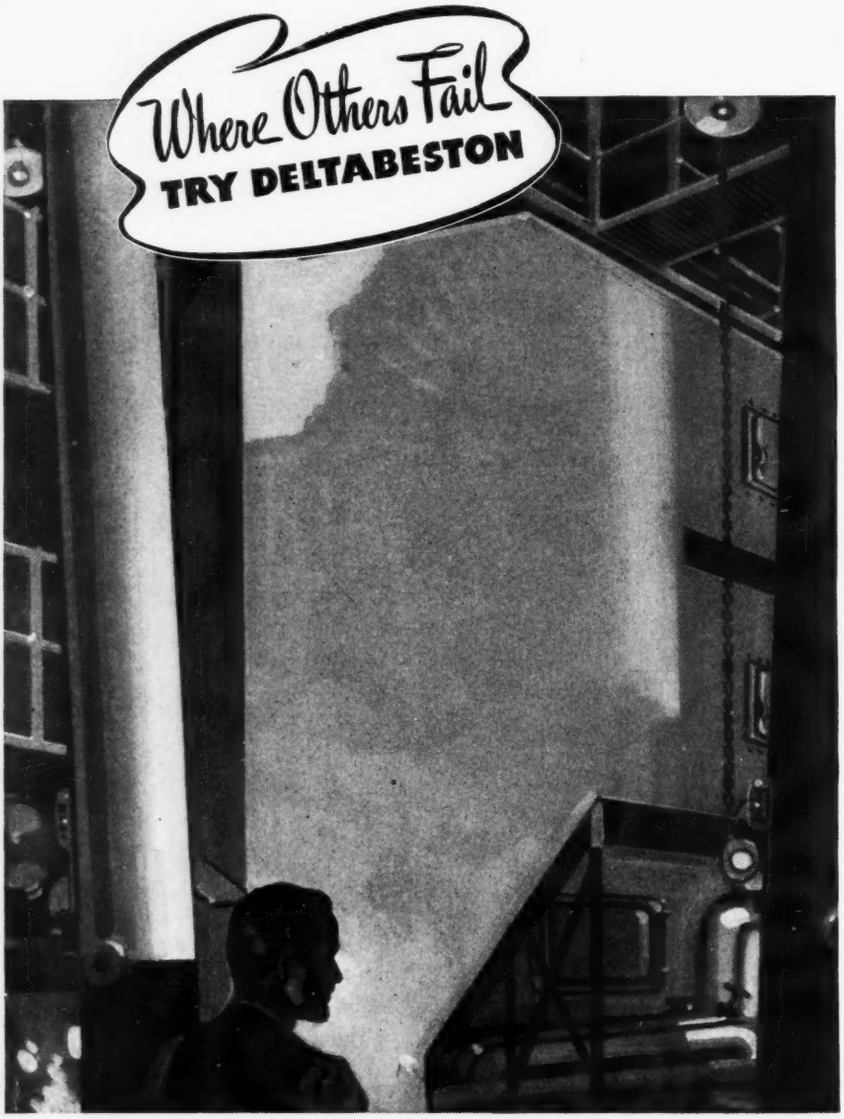


Not One . . Not Two . . All Three!

What is stopping your plant operations just at peak load time? What is wrecking the wire and cable in your boiler room? Is it heat . . . or humidity . . . or any other deteriorating influences? Or can all three be at work? Probably they are and their combined destructive power will raise havoc with most ordinary cables.

That's why you'll be glad to know about Deltabeston Boiler Room Wire—the wire that resists flame, heat, oil, grease and corrosive vapors. Use it in your next boiler room installation. It'll pay dividends!

Deltabeston Wires and Cables are distributed nationally by Graybar Electric Company, General Electric Supply Corporation and other G-E Merchandise Distributors. If you want more information call them or write to Section Y621-52, Appliance and Merchandise Department, General Electric Co., Bridgeport, Conn.

GENERAL ELECTRIC

OTHER EQUIPMENT

49 CASTINGS—Hammond Brass Works, Hammond, Ind. Data book contains standard specifications, applications and other related information. Also gives complete chemical analyses and physical properties of bronzes and alloys, along with microphotos to show the various metallurgical structures.

50 PAINT—Medusa Products Co, 1000 Midland Bldg, Cleveland, Ohio. 8-page booklet contains information on the painting of concrete, stucco and masonry, telling why a special paint is needed for these surfaces and how to paint them. Also furnishes typical application photographs.

51 COLLOIDAL GRAPHITE—National Graphite Co, 17 John St, New York, N. Y. Bulletin discusses the problem of graphiting light fuels and tells how Konag, a natural colloidal graphite is used for lubricating purposes. Several types of this product outlined and their uses fully described.

52 INDUSTRIAL BRUSHES—Keystone Carbon, Inc, St Marys, Pa. 24-page catalog price list K-15 of industrial brushes for sliprings, motors and generators and metal graphite and carbon products furnishes specifications for all products illustrated.

53 MINERAL WOOL—Industrial Mineral Wool Institute, 441 Lexington Ave, New York, N. Y. 8-page book entitled "Specification for Mineral Wool in Low Temperature Applications" features 12 perspective drawings illustrating approved methods of applying mineral wool insulation, providing the necessary vapor barrier, supporting and finishing off the insulation in various applications.

54 METAL CLEANING — Detroit Rex Products Co, 13005 Hillview Ave, Detroit, Mich. Illustrated leaflet describes methods used to solve industrial metal-cleaning problems. Also shows research, engineering and manufacturing facilities for production of degreasers, washers and chemical cleaners.

55 QUICK PATCH CEMENT—Smooth-On Mfg Co, Dept 306, 570 Communipaw Ave, Jersey City, N. J. Booklet introduces new product for quick patching of cracks, ruts, and shallow holes in concrete floors. Patches said to harden overnight, permit full traffic the following morning and become stronger with age.

56 METAL SPRAY—Metallizing Engineering Co Inc, 21-07 41st Avenue, Long Island City, N. Y. 16-page bulletin No. 42A describes the metallizing process and equipment for its application. Tells briefly how essential industries are eliminating replacements and increasing service life of equipment now difficult to replace.

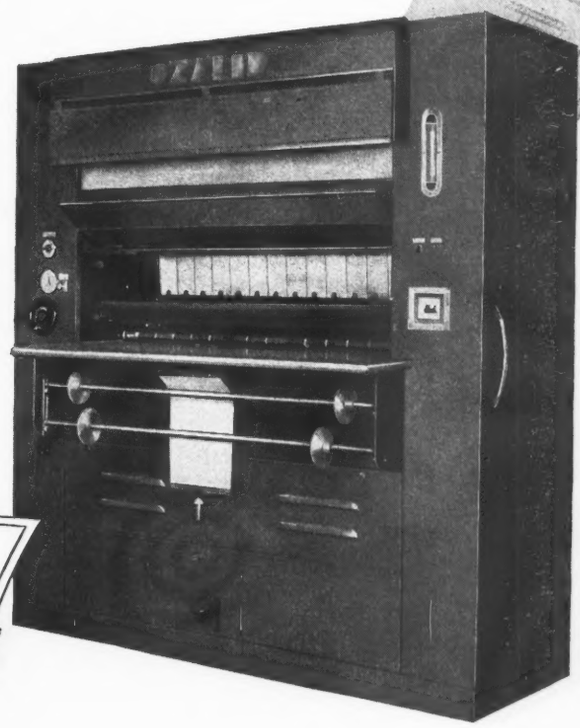
57 WIRE NUTS — Ideal Commutator Dresser Co, 1279 Park Ave, Sycamore, Ill. 4-page folder discusses Ideal Wire Nuts which save lead, tin and rubber as used in solder and tape joints. Nuts come in four sizes for joining all common combinations from two No. 18 to three No 10—solid or stranded wires.

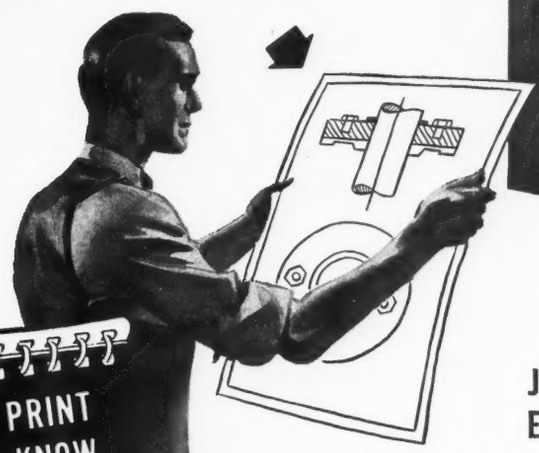
58 TOOL BRAZING AND REPAIR — Handy & Harman, 82 Fulton Street, New York, N. Y. Bulletin tells how cutting tools can be salvaged by brazing with Easy-Flo. Photographs illustrate typical applications where war demands for high production cause more than usual breakage.

59 PAINT — The Arco Co, Cleveland, Ohio. 16-page book describes the advantages of Infray paint for use in industrial plants. This paint blends into the color scheme of the surrounding terrain and has a rather dull surface to insure not giving a reflection of moonlight or sunlight. Also gives specifications as used on buildings, storage tanks, etc.

60 SLUDGE ELIMINATOR — Standard Chemical Co, Natick, Mass. Bulletin describes Kil-sludge, said to eliminate sludge conditions in tanks and pipelines that make combustion incomplete, waste fuel, and cut down efficient burning of fuel oil.

FROM TRACING TO FINISHED WHITEPRINT... IN 2 FAST STEPS





BASIC FACTS ABOUT PRINT MAKING YOU SHOULD KNOW

OZALID TRANSPARENT FOILS ARE USED TO RECLAIM OLD, WORN, OR SOILED ORIGINALS . . . thereby enabling you to make prints from valuable originals which otherwise are no longer serviceable.

The lines on marred original tracings are intensified in duplicate originals made with Ozalid acetate foil. Any spots, blotches or crease marks reproduced on a duplicate original can either be erased, or cleaned with Ozalid Corrector Fluid.

In this way you secure a fast-printing intermediate original which will produce subsequent prints having strong line detail and a clear background.

This is the fifth of a series of facts on modern printmaking. Watch for Fact No. 6.

JUST TWO OPERATIONS... EXPOSURE and DRY DEVELOPMENT—

and prints are made of your engineering drawings, charts, graphs... made quickly, so that print production won't be held up and planes, tanks, and ships will roll off the assembly lines without delay!

The Ozalid Process turns out positive-type whiteprints of your tracings in ***seconds***—a compact machine performing the only two steps necessary: printing and dry developing! The tracing is placed on a piece of Ozalid sensitized material and fed into the machine. The finished print is dry—ready for instant use!

Ozalid standard materials offer you a choice of either blue, black or maroon line prints on a white background. Then, there are transparent papers, cloth and foils for producing duplicate originals, and a varied line of special materials.

Today—when speed in every department is vital, an Ozalid machine in your printroom is the answer to speedy print production.

Write at once for literature describing the many advantages and the versatility of the Ozalid Process.

SPECIFY *Ozalid* WHITEPRINTS

OZALID PRODUCTS DIVISION
GENERAL ANILINE & FILM CORPORATION
JOHNSON CITY, N.Y.
Ozalid in Canada • HUGHES OWEN CO. LTD., Montreal

The Immediate Solution to Your Flexible Connection Problems!

Type RW-81
(annular corrugations)

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(helical corrugations)

REX-WELD* (corrugated) *Flexible METAL Hose

Sizes from ⅛″ I. D. to 4″ I. D. inc. Pressures to 14,500 p.s.i. Temperatures to 1000° F. One-piece, all-metal construction. Continuous lengths to 50 feet.

Rex-Tite Mechanical (Re-attachable) couplings; solder couplings; brazed and welded couplings and flange assemblies for Rex-Weld Flexible Metal Hose.

Complete Data on Request

CHICAGO METAL HOSE
CORPORATION
MAYWOOD, ILLINOIS

Engineers' Books

(*Continued from page* 130)

ors, installers and users. Beginning with a brief history of the early lamps, he moves smoothly into a comprehensive yet easily understood discussion of present lamp construction, lamp sizes, lumen outputs and other essential factors.

Auxiliary equipment, so vital to the efficient operation of the lamps, is treated in a full chapter. Reasons for auxiliary equipment given, and various types of ballasts, starters and compensators are covered in detail.

Perhaps the three most important chapters, from the user's standpoint, are those dealing with operating characteristics, installation hints and service suggestions. With the aid of these sections, the contractor, installer and user can design, install and maintain an efficient fluorescent lighting installation. Characteristics such as effect of surrounding temperatures, outdoor weathering of ballasts; installation hints such as lampholder mounting positions, methods of reducing stroboscopic effect; and service suggestions such as cures and reasons for radio interference, flicker, and blackening all make up one section of the book that will help immeasurably, both to clear up misunderstandings about the lamps, and to assist in making the installation the most efficient possible.

Luminaire selection, lamp design, color quality, applications and lighting economics make up the balance of the book. This is a volume which undoubtedly will prove invaluable to the reader who wants to know the what, where and why of fluorescent lamps.

Safety

SAFETY RULES FOR THE INSTALLATION AND MAINTENANCE OF ELECTRIC-SUPPLY AND COMMUNICATION LINES. (5th edition, 1941) *Published by United States Government Printing Office, Washington, D. C. 177 pages, 5x7.5 in., cloth binding. Price 65 cents.*

In this Code, known as National Bureau of Standards Handbook H32 and approved standard of the American Standards Association, are outlined safety rules for the construction, maintenance and operation of systems supplying electrical energy for light, heat and power as well as for communication and signal systems and radio installations. Among the subjects included are methods of protective grounding of over-

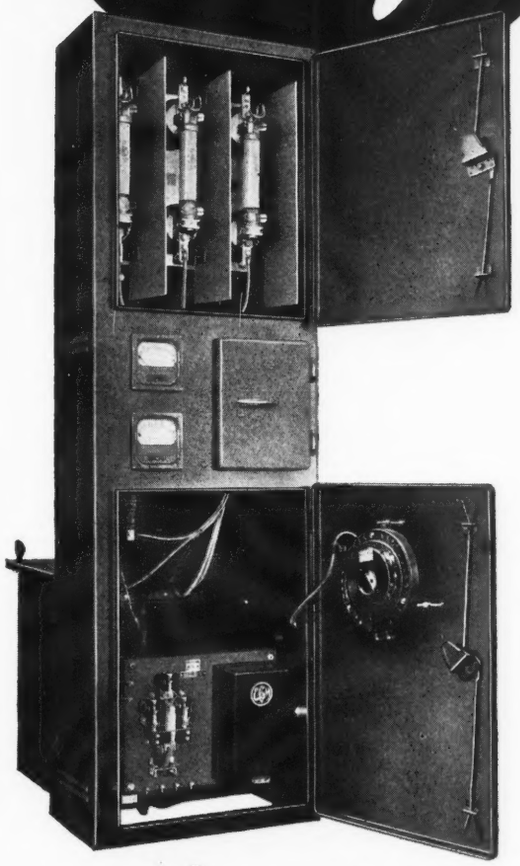
2300 VOLT STARTERS for

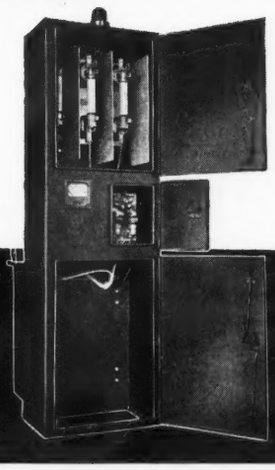
SYNCHRONOUS MOTORS

★

SQUIRREL-CAGE MOTORS

Completely Assembled Units with Built-in Short-circuit Protection





★ EC&M builds motor starters to suit the individual application. These views show a full-voltage, *completely automatic* starter for 2300 volt synchronous motor and a reduced-voltage, auto-transformer starter for 2300 volt squirrel-cage motor.

Each is a totally enclosed unit with all internal wiring complete. The unit comes *ready to set in position.* It is only necessary to connect power and motor leads and wire the push button. This speeds installation and at the same time provides an attractive, shock-proof job.

Of special interest are the disconnect fuses giving short-circuit protection. These are selected with sufficient capacity to meet normal motor currents and also have sufficient rupturing capacity to meet the requirements of the power-feeder circuit. Motor protection is supplied by EC&M Type ZM Overload Relays which have a reputation throughout industry for accuracy and reliability.

For 2300 volt Motor Starter information, ask for Bulletins 1047-A and 1077.

Disconnect fuses are accessible through upper-door which is equipped with safety interlock. Overload Relays and Meters, when used, are mounted in middle section. Lower compartment, providing space for automatic field switching mechanism for synchronous motors, has ample space for bringing in cable, for mounting potheads, if desired, etc.

THE ELECTRIC CONTROLLER & MFG CO.

CLEVELAND OHIO

THE ELECTRIC CONTROLLER & MFG. CO. E&M CLEVELAND, OHIO

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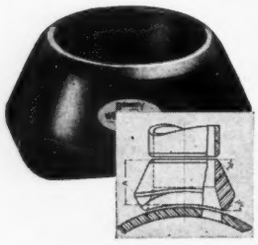
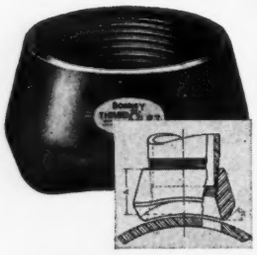
TRADE MARKS - REG. U.S. PAT. OFF.
THREDOLETS
. . . Welded Outlets for Piping . . .

Any One or All 3 Will Make Any Right-Angle Welded Branch Pipe Outlet

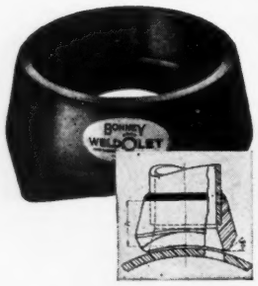
TEES, Crosses, Side Outlets, Side Outlets and Crosses or Double Crosses . . . any one or all can be made with Bonney WeldOlets, ThredOlets or Socket-End WeldOlets.



WELDOLET



THREDOLET

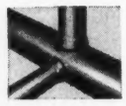


Socket-End WELDOLET

Every branch pipe outlet made with a WeldOlet, ThredOlet or Socket-End WeldOlet will provide a leakproof junction of full pipe strength that reduces friction and turbulence to a minimum.

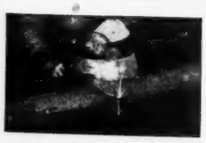
No templets are required for cutting the hole in the main pipe . . . no complicated forming or fitting is necessary . . . alignment of the main and branch pipes is simplified. The position of the outlet is selected and the WeldOlet, ThredOlet or Socket-End WeldOlet welded in place . . . the hole in the main pipe, in most cases, being made after the fitting is installed.

Bonney WeldOlets, ThredOlets and Socket-End WeldOlets are stock fittings of drop forged steel with outlets from 1/4" to 12". On special order they can be furnished in sizes up to 24" x 24". To meet special conditions they can also be supplied in wrought iron, Toncan iron, brass, Monel, Everdur, etc. They are adaptable to every type of piping system and for all commonly used pressures and temperatures.

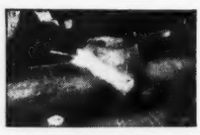


Your local distributor will be glad to give you complete information or write for Bulletin WT29 describing all their advantages.

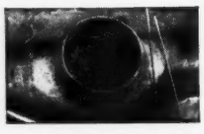
EASILY INSTALLED



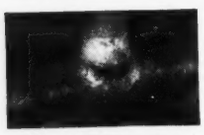
Mark center lines and tack the fittings into place.



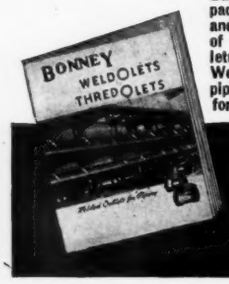
Then weld the fitting to the main pipe.



Remove the button which will also permit inspection of the inside of the joint.



Then attach the branch pipe.



Bulletin WT29—20 pages packed with information and data on advantages of WeldOlets, ThredOlets and Socket-End WeldOlets in all types of piping installations. Write for your copy NOW.

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FORGED FITTINGS DIVISION
ALLENTOWN, PA.

head and underground lines and related equipment; relations between various classes of lines, conductor, separation and clearances, grades of construction for conductors and supporting structures, strength requirements, line insulators, rules for ungrounded lines and protection of conductors buried in earth and installed in duct systems. The most extensive changes made in this edition will be found in Section 9, which were made to remove conflicts on protective grounding in these rules and in the National Electrical Code.

THE SECOND MILE *by W E Wickenden, president, Case School of Applied Science. Distributed by Engineers Council for Professional Development, 29 W 39th St, N.Y.C., N.Y. Price 10 cents per single copy, 5 cents in quantities, $3.00 per 100.*

This 6-page revision of an address by Dr Wickenden is addressed to every engineer who thinks of himself as a "professional man." With profound penetration, it seeks the essential nature of professional work, outlines the history and characteristics of the various professions, and relates all this to the work, the thinking and the life of the engineer. Magnificently thought out and written, this document will do much to set engineers, both young and old, on the right track.

Brief Reviews

HOW TO RUN A LATHE—(Fourth edition. (1942) *Published by the South Bend Lathe Works, Dept. 5P, South Bend, Ind. 128 pages, 5⅛x8 in., over 365 illustrations. Price 25 cents.* Contains latest information on operation and care of metal-working lathes. Covers such subjects as the operation of the lathe units, grinding cutter bits, making accurate measurements, plain turning chuck work, paper turning, boring, drilling, reaming, tapping, cutting screw threads, reference tables, etc. A number of changes in text material and illustrations have been made since the previous edition was published in 1941.

ORGANIC METHODS OF SCALE AND CORROSION CONTROL—(Fourth edition 1941) *Published by D W Haering & Co, 205 West Wacker Drive, Chicago, Ill. Available without charge to those addressing request on business letterhead.* Largely rewritten and enlarged to accommodate additional information, this 28-page discussion of organic methods presents information on scale and corrosion control. In addition to the

Industrial Power

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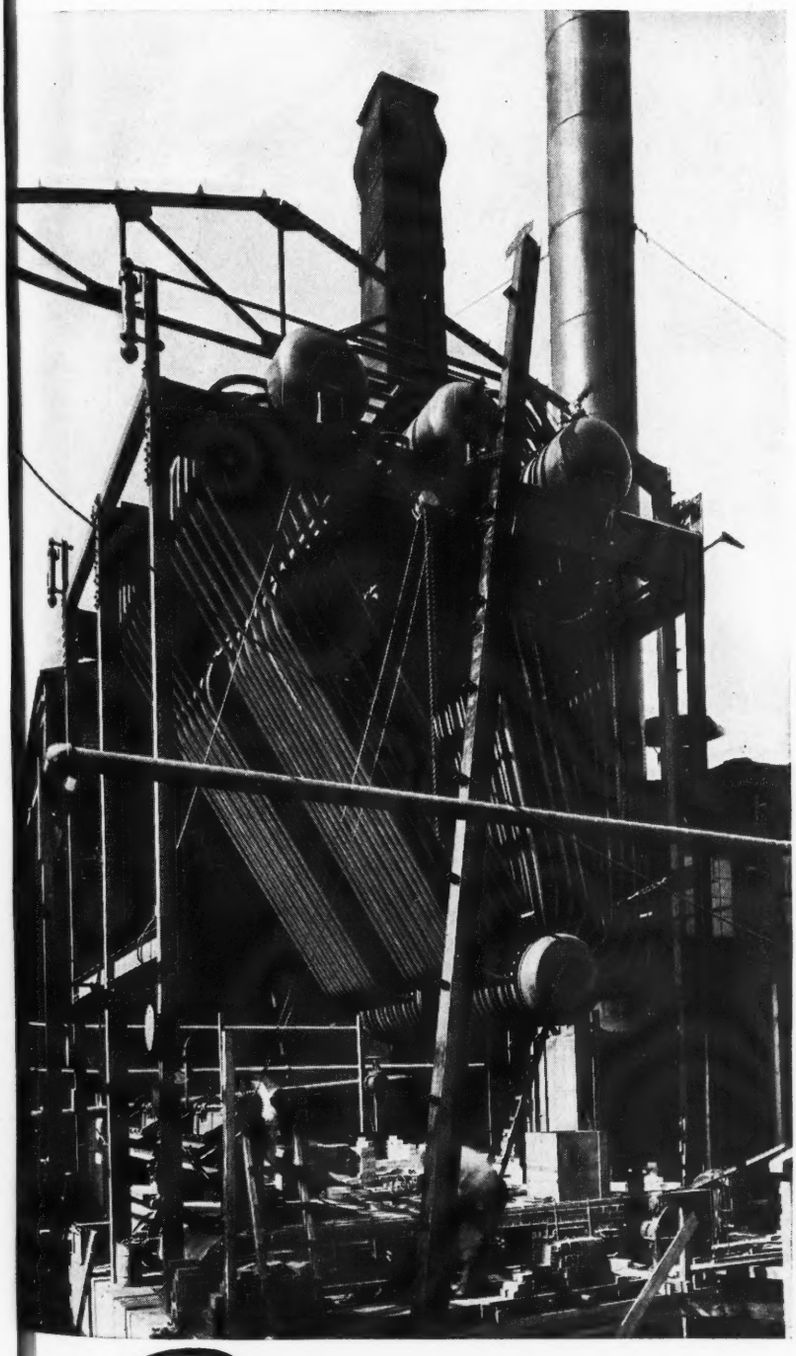
ELECTRUNITE



☆ With *Production for War* making greater demands than ever before in our industrial history—with the military value of one plane, tank, gun or ship available today probably worth that of a dozen tomorrow—everything depends on industrial power.

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Because they are easy to install (users report up to 30% savings) and they can be depended on for long, trouble-free service, the entire present output of Republic ELECTRUNITE Boiler Tubes is earmarked for *Production for War.* This sometimes forces us to say "Not now" to our friends and old customers.

If your business is a part of a war industry, you'll want to know immediately about the saving accomplished by Republic ELECTRUNITE Boiler Tubes. In any event, you'll want to be informed about their superior performance. Write for details.

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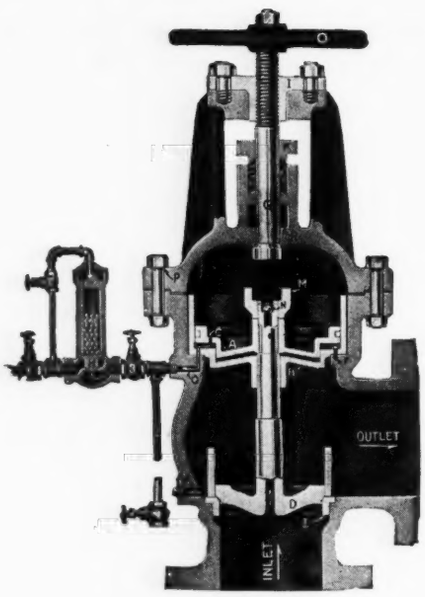
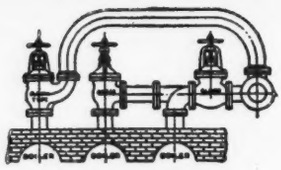
Golden-Anderson

SPECIALTY

VALVES





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discussion of organic chemicals, the new edition includes an explanation of causes of scale and corrosion and introduces a new section tabulating the physical and chemical properties of the various glucosates.

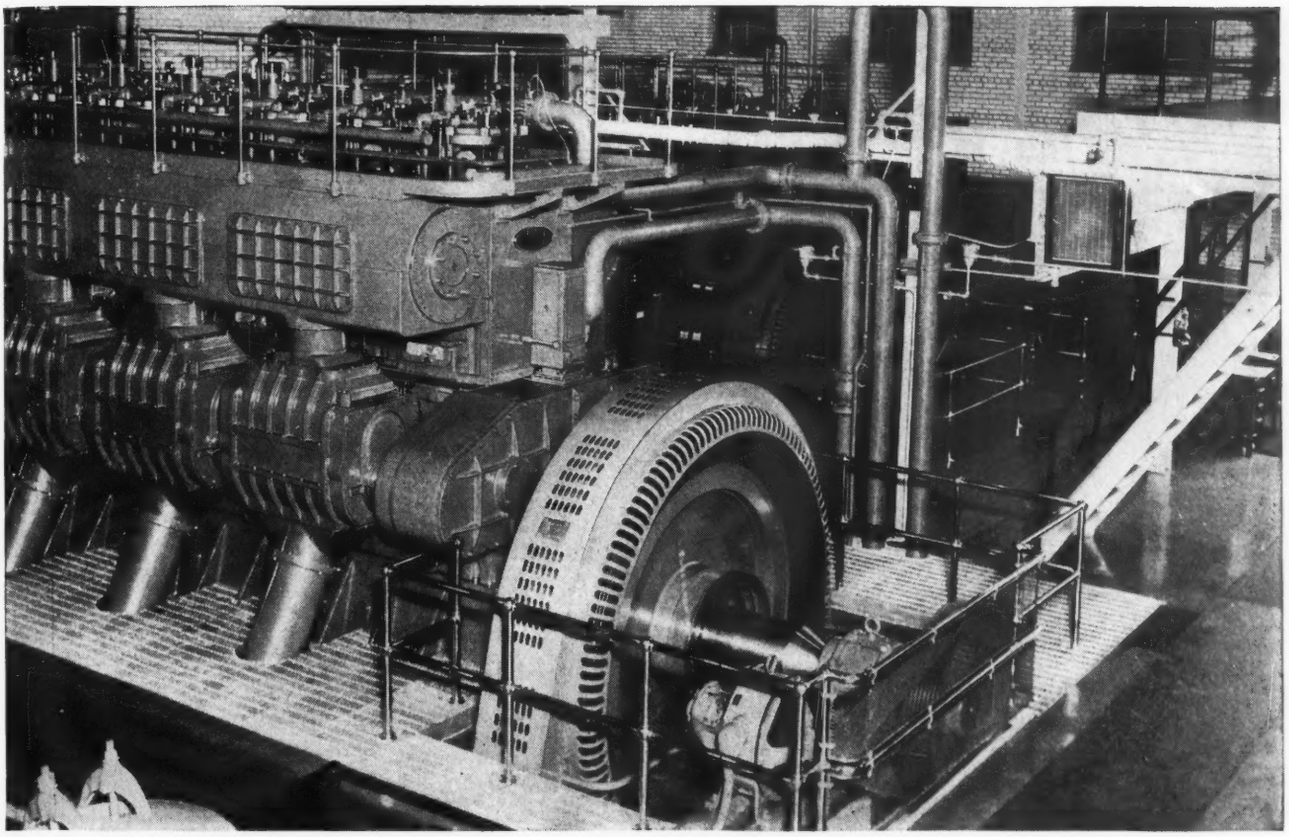
PLANT DISTRIBUTION SYSTEM—*Published by the Westinghouse Electric & Manufacturing Co, East Pittsburgh, Pa. Available without charge. Covering everything from substations and switchgear to small auxiliary equipment, the book describes radial and secondary network distribution systems. Divided into four parts, the scope of the book covers radial systems, bank transformer systems, plant network systems, and associated electrcial apparatus. In all cases typical applications and specifications for standard units of equipment are described.*

BUILDING PROCEDURES—*Published by Air Reduction, 60 East 42nd St, New York, N. Y. Single copies available on request.* In addition to recommending the processes, this book recommends the best filler metals to be used for each process, describes first-class welding technique not commonly known. In an appendix, data is given for the calculation of electrode and gas welding rod consumption for different types of welds; also comparative welding record sheets for tabulating data that will determine the best welding method for a particular job.

MEEHANITE METAL—*Published by the Meehanite Metal Corp., 311 Ross St, Pittsburgh, Pa. 48 pages, spiral bound. Price $1. Single copies available when requests are made on a business letterhead giving company and title.* This is a complete handbook on Meehanite describing manufacture, metallurgy and engineering properties.

TRAINING OXYACETYLENE WELDING AND CUTTING OPERATORS—*Published by the International Acetylene Association, 30 East 42nd St, New York, N.Y. 26 cents per copy, de luxe edition, 75 cents. 88 pages, paper bound.* Contains an instructive outline for the training of oxyacetylene welding and cutting operators, and includes an outline course for inspectors. All necessary instructions covered in detail.

HEAT INSULATION HANDBOOK—*Published by the Ehret Manesia Manufacturing Co, Valley Forge, Pa. 176 pages, paper bound, 91 drawings, and 24-page data section.* Included in this ready-reference volume is a comprehensive installation recommendation section, illus-



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Makers of Packings for Every Industrial Use

trated with drawings and photographs of application details. A short section on technical information covers the history of thermal installations in industry, installation principles and practice, with numerous examples. Interspersed is technical data with information on the company's product.

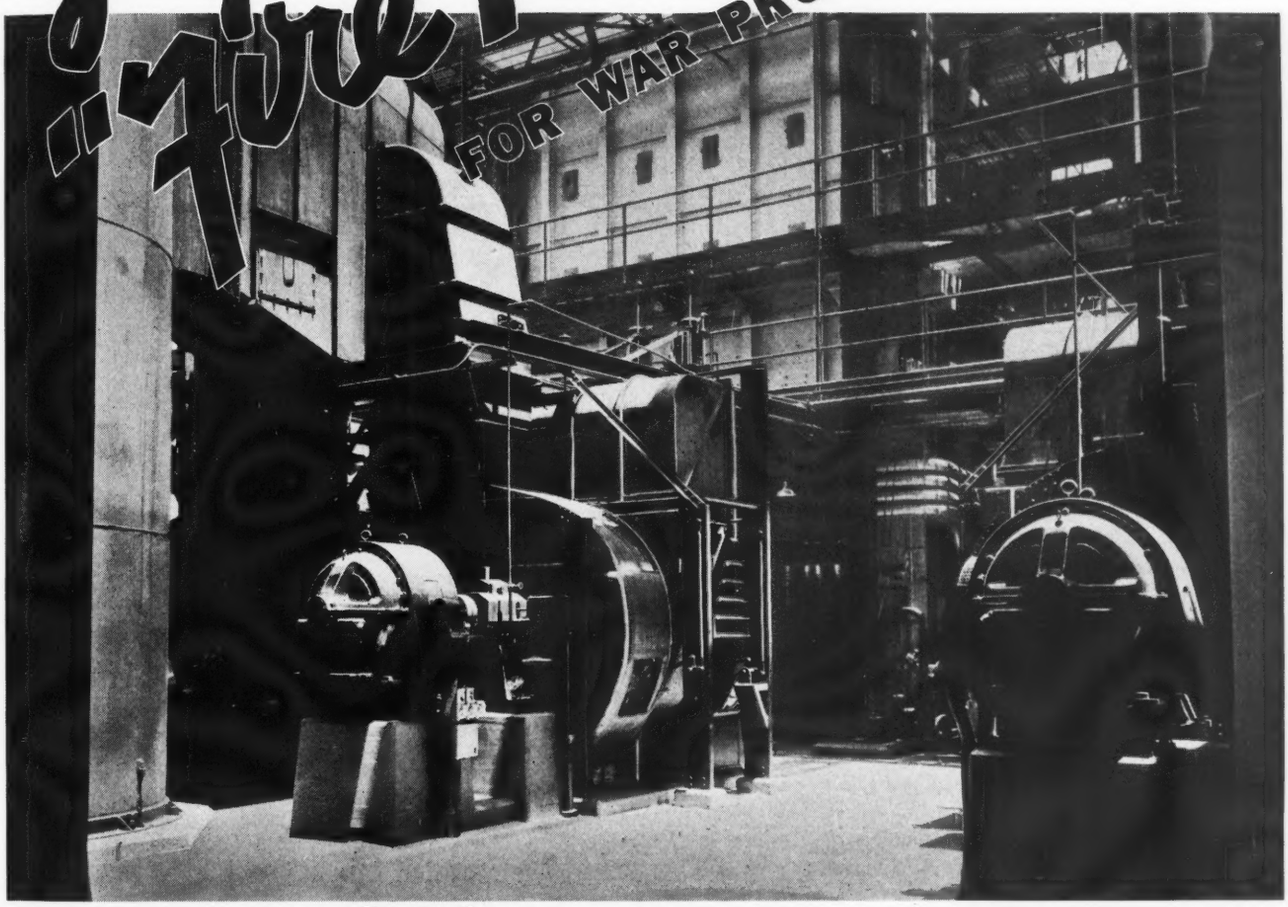
LEFAX DATA—The following have been made available by Lefax, Inc., Philadelphia, Pa., and may be of interest to POWER readers; No. 36–75. "Protective Treatment for Concrete"; No. 4211, "Steel Butt-Welding Fittings"; No. 31–55, "Floor Loads"; No. 42–14, "Jig Bushings"; No. 5–218, "Cast Iron Screw Fittings"; No. 42–4, "Lubrication Theory"; No. 8–25, "Insulation for Steam Piping"; No. 14–46, "Conductors for Wiring"; No. 14–223, "American Standard Screw Threads"; No. 42–20, "Bombs and Bomb Shelters"; No. 31–96, "Concrete, Reinforced Building Regulations"; No. 12–112, "Physical Properties of Aluminum Alloys"; No. 11–227, "Measurement of Fuel Oil"; No. 30–63, "Properties of Wire Rope"; No. 12–463, "Standard Rubber and Balata Belting Lifts"; No. 42–21, "First-Aid Principles for Air Raid Wardens"; No. 42–21, "Steam Flow Characteristics of Extraction Turbines."

POSITIVE DISCONNECTION OF DISTRIBUTION CIRCUITS DUTING FAULTS TO GROUND—*Engineering Report No. 47, published by the American Telephone & Telegraph Co, 195 Broadway, New York City, and the Edison Electric Institute, 420 Lexington Ave, New York, N. Y. Paper bound, 36 pages. Price 60 cents to EEI members and their employees; price, $1.50 to non-members in United States; price, $1.60 to foreign countries, postpaid.* This report gives the results of a study of means for insuring positive disconnection of distribution circuits during faults to ground, particularly from the standpoint of coordination of telephone facilities which are jointly supported on the same poles with the higher voltage distribution circuits. The report includes a brief discussion of important factors involved in providing protection for telephone circuits during contact with distribution circuits, a consideration of the factors involved in applying ground relaying to distribution circuits, the results of extensive oscillographic observations on the characteristics of distribution circuit ground faults and the performance of distribution circuit protective devices, and other matters.

HOW TO GET MOST SERVICE OUT OF INDUSTRIAL RUBBER PRODUCTS—*Pub-*

Greater "Fire Power"

FOR WAR PRODUCTION BOILERS



. . WITH "Buffalo" FORCED AND INDUCED DRAFT FANS

On every Industrial Front, Buffalo Fans are helping keep the fires roaring, boiler pressures at peak capacities, generators humming. The production drive is on to Victory! And Buffalo Fans tackle their job with characteristic dependability. Their extra rigid construction . . . vibration-free rotors . . . practical housing designs — indeed, every Buffalo detail is matched to the emergency demand for 24-hour-a-day service. And long after the war is over Buffalo Mechanical Draft Fans will keep right on performing — as reliable as ever!

BUFFALO FORGE COMPANY

488 Broadway, Buffalo, N. Y.

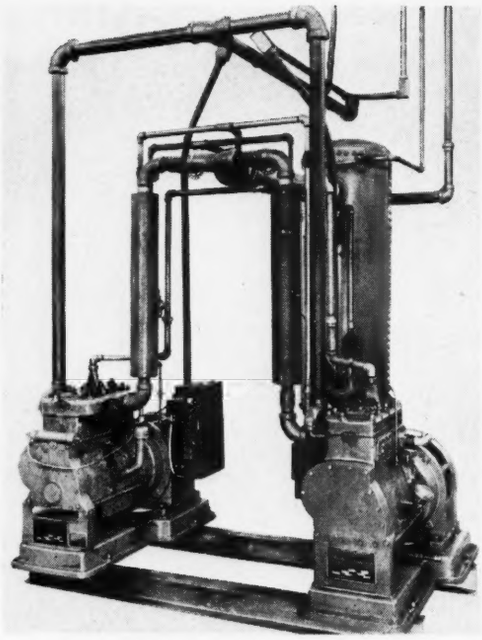
Branch Engineering Offices in Principal Cities

Canadian Blower & Forge Co., Ltd. Kitchener, Ont.

"Buffalo" MECHANICAL DRAFT FANS

Automatic supply of compressed air available as needed

WITH RUGGED, COMPACT "BUILT-IN" SCHRAMM COMPRESSOR UNITS



● The two Schramm Compressors shown here are installed in a plant where large volumes of air are required at certain periods in the production cycle. However, this maximum volume is demanded for only about 20% of the total production time.

Ability to supply air exactly as needed is achieved by using a unit system with automatic controls. This system permits the operation of one compressor only when air consumption is at a minimum. However, when demands for maximum air occur, the second compressor automatically cuts in and provides the additional air required until such time as demands fall off when the second compressor automatically cuts out, leaving only one unit to carry the load.

This advantageous system of being able to cut units in or out of service in response to demands results in power savings as well as unnecessary wear and tear on compressors. Another advantage, made possible by the Schramm unit system, is the fact that there is always an auxiliary unit available for emergency use during the periods when demand is low. No power is wasted; continuous air supply is assured.

INVESTIGATE IMMEDIATELY

Schramm Compressors—in capacities from 20 to 420 cu.ft. per min. (actual air delivery at 100 lbs.) They can be installed in any convenient location.

Available for pulley, V-belt, or direct-coupling drives, with and without cooling unit, motor or engine (gasoline or diesel).

SEND AT ONCE FOR CATALOG NO. 42-S GIVING COMPLETE DETAILED SPECIFICATIONS

SCHRAMM, INC., WEST CHESTER, PA.

SCHRAMM *Air Compressors*

lished by the B F Goodrich Co, Akron, Ohio. Paper pamphlets, furnished free on request. Titles of the six pamphlets are, "Transmission Belting"; "Conveyor Belts"; "V-Belt Drives"; "Belt Salvage"; "Rubber Hose," and "Mats and Matting." Each states in clear language the steps to take for preserving the vital material by exercising normal care in everyday work.

SIMPLE BLUEPRINT READING WITH SPECIAL REFERENCE TO WELDING (Second edition 1942). *Published by the Lincoln Electric Co, Cleveland, Ohio. 146 pages, 5½x8½ in, 96 drawings; covers, semi-flexible simulated leather. Price, 50 cents postpaid in United States; 75 cents elsewhere.* More than 50 drawings have been revised in the new edition of the volume, designed to aid and instruct anyone who must read blueprints, although the book has been especially published for those in the welding field. Text gives the student a clear understanding of the symbols used in drawing various types of welding joints, including butts, corners, fillets.

New Power Construction

Construction to Come

Alabama — Tennessee Valley Auth. Knoxville, Tenn., plans constructing plant. $6,000,000.

Alabama—U. S. Steel Corp, 208 S La Salle St, Chicago, Ill., plans constructing plant. Defense Plant Corp will finance.

Ala., Gorgas—Bids May 12 by Alabama Power Co, 600 N 18th St, Birmingham, constructing substructure, superstructure steam-generator plant. $6,000,000.

Arizona-Nevada—Bids May 25, by Bureau Reclamation, Denver, Colo., furnishing five 62,200-hp hydraulic turbines and five oil-pressure actuator governors, pump equip in Davis Power Plant, Davis Dam, Spec 1033.

Arkansas—Defense Plant Corp, 811 Vermont Ave, N W, Wash., D. C., plans constructing plant. To exceed $5,000,000.

California—Columbia Steel Co, 2087 E Slauson Ave, Los Angeles, plans constructing plant addn. $3,500,000. Federally financed.

California—Industrial company plans constructing plant. Defense Plant Corp will finance. D R Warren, 816 W 5 St, Los Angeles, engr.

Calif., Napa—State, specifications completed, awaiting approval, constructing Rector Dam, Napa Co. $1,000,000. E Hyatt, P Wks Bldg, Sacramento, state engr.

Calif., Redding—Pacific Gas & Electric Co, 245 Market St, San Francisco receiving bids constructing power house, related structures. Pit River No 5 Powerhouse.

Calif., San Francisco—City and San Francisco Co plans $1,250,000 bond election June 9, auxiliary pump plant, Lake Merced.

Calif., Sebastopol—Sebastopol Cold Storage Co, Sebastopol, plans constructing cold-storage plant addns. $45,000.

Connecticut—Industrial company plans constructing magnesium plant. $2,500,000. Defense Plant Corp will finance.

Conn., Bridgeport—Pub Wks Dept, P Brewster, dir, plans constructing sewage disposal plant, Seaview Ave, $1,000,000. H L Rowland, City Hall, engr.

Bartlett-Snow

CENTRAL STATION EQUIPMENT

—including rail, boat and truck receiving facilities, large capacity belt conveyors, feeders, bunkers, crushers, distributors, coal storage and reclaiming systems, meets every central station requirement. Eng. Bul. No. 83, describing recent installations and giving construction details of typical equipment units, sent on request. The C. O. Bartlett & Snow Co., 6205 Harvard Ave., Cleveland, Ohio.

What are you doing to keep coal costs down while steam demands go up?

Have you tried buying B.T.U.'s figured from testing coal with the . . .

Improved

STURTEVANT AUTOMATIC COAL CRUSHER and SAMPLER

Now is the time to take advantage of the surplus mine and transportation capacity to stock up on coal to the limit of your storage capacity.

But in following this sound advice, be sure that the coal you buy will not impair your boiler performance at a time when increased boiler capacity is essential to the power needs of war production.

Now is the time as never before to sample the coal you stock the "STURTEVANT WAY"—and know that you'll be properly protected in B. T. U. content and cleanliness against inefficient boiler operation and draft loss due to inferior, dirty coal.

The job of storing your coal, now, while it is still available, means that hand sampling is too slow and inaccurate a procedure to follow. Samples must be taken quickly and accurately. And that is where the fast accurate IMPROVED STURTEVANT AUTOMATIC COAL CRUSHER and SAMPLER fits right into the needs of the present emergency.

FOR EXAMPLE: The "STURTEVANT WAY" eliminates 32 of the 34 operations ordinarily required by hit-or-miss, laborious, inefficient hand sampling. Coal or coke fed into the machine is crushed between fine toothed crushing disc and stationary liner and thoroughly mixed to a truly representative correctly proportioned mixture.

This finely crushed material (approximately 8 mesh and finer) is uniformly discharged in 5, 10 or 15% samples as desired through "sample" spout thoroughly and automatically prepared for test. The possibility of human error is completely eliminated. Samples of coal prepared by the "STURTEVANT" method can therefore be depended on as being truly representative.

This improved machine, requiring only 3 hp. is sturdy, long-lived, compact and convenient and provides the means for instant sampling.

Stock Coal Now . . . but Sample it before You Burn it . . . Write today for Bulletin 85

Sturtevant Mill Co.

103 Clayton St., Dorchester, Boston, Mass.

Conn., Fairfield—Town, F S Shaw, chn com, Mill Hill, Southport, plans constructing sewage disposal plant, incinerator and garage. Over $25,000.

Delaware—Bids May 6, by State Hwy Dept, Dover, constructing concession bldg, Indiana River Inlet, Sussex Co, Contr 807; air conditioning unit for drafting room in admin bldg, Dover, Kent Co Contr. 815. W W Mack, ch engr.

Idaho—U S Eng, Pittock Blk, Portland, Ore., plans constructing improvements $5,000,000.

Illinois—Fairbanks, Morse & Co, Beloit, Wis., plans expanding factory, for Navy Dept.

Illinois—War Dept, 20 St and Constitution Ave N W, Wash., D. C., plans constructing plant. Industrial company will operate. Albert Kahn & Associates, 345 Center Bldg, Detroit, Mich., engrs and archts.

Ill., Chicago—Dept Pub Wks new specifications constructing water filtration plant, superstructure, 79 St plant. $2,000,000.

Ill., Dixon—Bids about June 20, by Illinois Northern Utilities Co, Dixon, constructing bldgs for power plant addn. $6,000,000. Bids about May 20 for structural steel. Sargent & Lundy, 140 S Dearborn St, Chicago, Ill., engrs.

Indiana—Standard Oil Co of Ind., 1915 Front St, and Carbon & Carbide Chemical Co, Standard Ave, both Whiting, plans constructing, $50,000,000. Federally financed.

Indiana—United States Steel Corp, 208 S La Salle St, Chicago, Ill., plans constructing plant. Defense Plant Corp will finance.

Iowa, Keokuk—Bids May 5 by Kenneth R Brown, consult engr, Nemmers & Clark, Hubbell Bldg, Des Moines, constructing superstructure power house, for Keokuk Electric Metals Co, Keokuk. Est $650,000 incl equip.

Kansas—U S Eng, Fort Riley plans constructing bldgs. $6,000,000.

Kansas—U S Eng, 601 Davidson Bldg, Kansas City, Mo., plans constructing plant. To exceed $5,000,000. Lozier Eng Co, 1907 Grand Ave, Kansas City, Kans., engr and archt.

Kansas—U S Eng, 601 Davidson Bldg, Kansas City, Mo., plans constructing plant. $100,000,000.

Louisiana—U S Eng, foot Prytania St, New Orleans, plans constructing imprvs, bldg, etc. $6,000,000.

Me., Kittery—Federal Works Agency, F St between 18 and 19 Sts, Wash., D. C., plans constructing sewage plant, incinerator. $150,000. Haller Eng Assn, Inc, 38 Memorial Dr, Cambridge, Mass., engrs.

Maryland—Bids May 6, by Bethlehem Steel Co, 1101 Key Highway, Baltimore, constructing imprvs, shops, power house, etc.

Maryland—U S Eng, 1 and Douglas Sts, Wash., D. C., plans constructing plant. To exceed $5,000,000. Kelly Springfield Eng Co, Cumberland, Md., will operate.

Massachusetts—U S Eng, Park Square Bldg, Boston, plans by Lockwood Greene Engineers, Inc, 10 Rockefeller Plaza, New York, N. Y., constructing plant. Over $5,000,000. Morton C Tuttle Co, Park Square Bldg, engrs.

Michigan—Haskelite Corp, 701 Ann St N W, preparing plans constructing brick, steel, rein-con plant. $2,400,000.

Minn., Duluth—Minnesota Power & Light Co, 30 W Superior St, plans constructing substation, foot W 50 Ave $2,700,000.

Minn., Springfield—Bids May 18 by City, A C Mueller, city clk, imprv light and power plant, incl bldg addns, alterations, watertube boiler, stoker, etc. Over $40,000. Charles Foster, 316 Medical Arts Bldg, Duluth, engr.

Mo., Rolla—Bd Curators Missouri School of Mines and Metallurgy, L Cowan, secy, Jesse Hall, University of Missouri, Columbia, plans by Klipstein & Rathmann, 316 N 8 St, St Louis, constructing boiler house.

Nebraska—U S Eng, 1709 Jackson St, Omaha, plans constructing plant. Over $1,000,000. Industrial company will operate.

Neb., Sidney—Consumers Pub Power Dist, W P Venable, dist mgr, plans constructing power plant addn, large diesel generating unit, transmission lines, transformer substation. $96,000.

N. H., Portsmouth—Bids May 17, by City, Street Comrs, City Hall, constructing Sherburne and Haven pump stations addns, alterations. $15,000. FWA. Whit-

Victory will be measured in gallons

When you hear, with bated breath, how close the enemy has come to a victory with some raid of fifty or a hundred planes, you may wonder what merciful fate kept them from using a thousand. It was more likely lack of *fuel*, not fate, that stayed them.

To reach more oil, the Axis has been flailing about Europe and Asia like a monster, sacrificing lives by the hundreds of thousands.

The American petroleum industry, with half the world's reserves, and a tremendous production of the finest gasolines and oils, is our greatest guarantee of ultimate victory.

For the petroleum industry, Koppers has built plants to remove the corrosive hydrogen sulfide and recover the sulfur in a form that can be readily converted into war-important sulfuric acid.

Koppers produces chemicals to help make gasolines anti-knock; ingredients for the manufacture of inhibitors to prevent gum formation in gasoline; chemicals for solvent refining and dewaxing for the improvement of lubricating oils; chemicals that improve the pour point and film strength of oils.

Among other products which Koppers furnishes to the petroleum industry are piston rings; Fast's self-aligning couplings; pressure treated piling, lumber and timber. In its service to the petroleum industry, Koppers feels that it is helping write the history of the war. Koppers Company, Pittsburgh, Pa.

KOPPERS

THE INDUSTRY THAT SERVES ALL INDUSTRY

BUY UNITED STATES WAR BONDS AND STAMPS

HAULING JEEPS ACROSS RAVINES

Another Job for Wickwire Rope

There are many *extra* jobs that wire rope must do today. The Army, the Navy, and the Liberty Fleet need vast quantities of wire rope.

This points up the message: MAKE YOUR WIRE ROPE LAST LONGER.

When wire rope fails too soon, it wastes badly needed steel, labor and time. If by care you can make *your* wire rope last longer, you are helping to win the war.

When you *do* need wire rope, be sure to get the correct type and size for your service. Our representatives will help you determine the best Wickwire Rope, preformed or Wissco lay, for your use—and after installation will help you get longest life and most economical operation from it.

The reason for the long life of *Wickwire* rope lies in our controlled production, every step of the way from ore pile, to blast furnace, to open hearth, to finished rope.

• • •

Have you a copy of the book "Know Your Ropes"? It will help *you* get longer rope life. More than 25,000 wire rope users all over the world regard it as the authoritative guide to wire rope economy. For your free copy, write Wickwire Spencer Steel Company, 500 Fifth Avenue, New York, N. Y.

WHEN WIRE ROPE LEAVES ITS IMPRINT in sheave or drum groove, there is a filing action on the rope at every start and stop. Grooves having the slightest impressions should be machined and polished. This and forty more rope life-savers are pictured and described in "Know Your Ropes."

SEND YOUR WIRE ROPE QUESTIONS TO WICKWIRE SPENCER

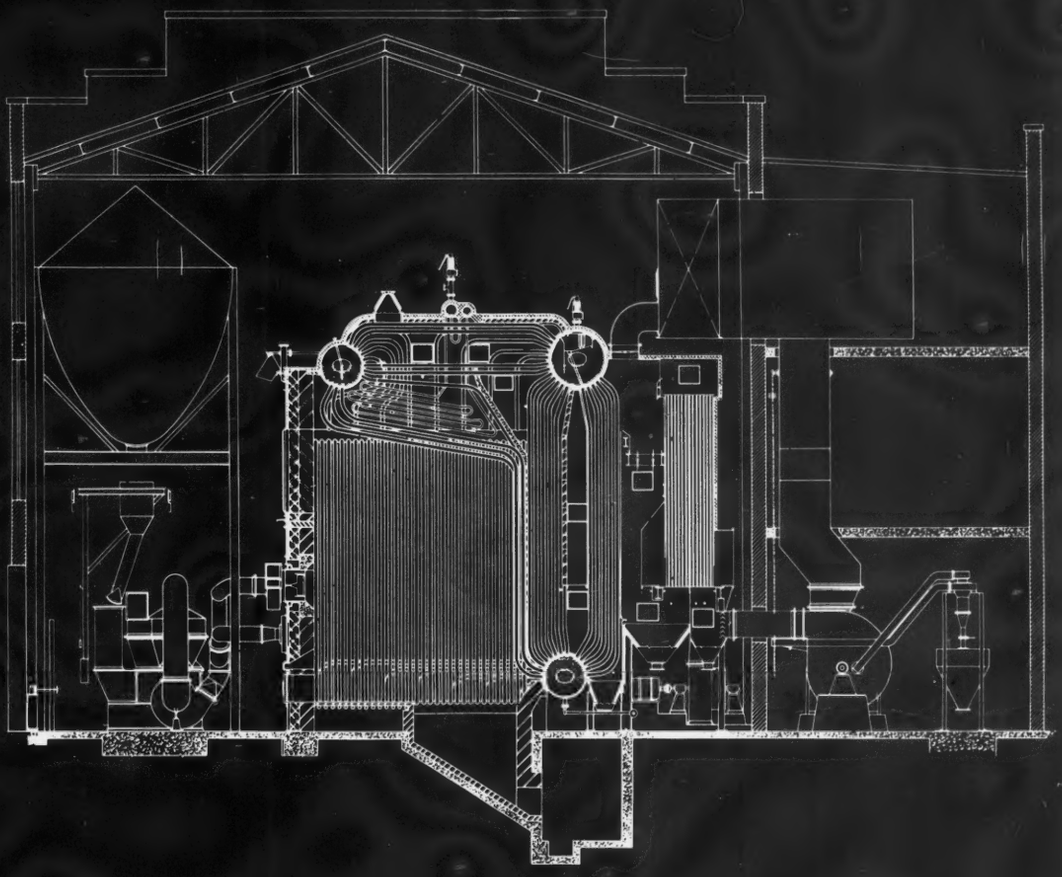
WICKWIRE SPENCER STEEL COMPANY

WICKWIRE ROPE

Sales Offices and Warehouses: Worcester, New York, Chicago, Buffalo, San Francisco, Los Angeles, Tulsa, Chattanooga, Houston, Abilene, Texas, Seattle. Export Sales Department: New York City

WISSCO PRODUCTS

THIS EDGE MOOR RADIANT HEAT BOILER for efficient steam generation in a small utility plant CAN BE REPRODUCED WITHOUT DELAY . . .



The pulverized fuel fired Edge Moor steam generating unit shown is producing 50,000 lb. of steam per hour at a pressure of 425 lb. and a steam temperature of 700° F. for supplying steam to turbines for light and power in a small utility plant.

The unit is equipped with Edge Moor Water Walls, Superheater, and Air Preheater.

Duplication of this steam generating unit can be accomplished with minimum loss of time because all plans are ready making it possible to go into production promptly. Ask for complete information on Edge Moor boilers ready for prompt reproduction.

Complete installation service is available.

EDGE MOOR IRON WORKS, INC. 30 ROCKEFELLER PLAZA NEW YORK, N. Y.

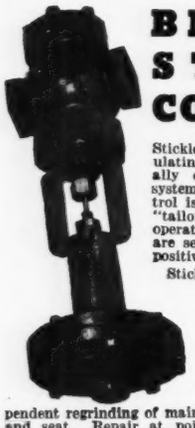
KANSAS CITY CHICAGO DETROIT RICHMOND, VA.

IN CANADA:— UNITED STEEL CORPORATION, LTD., TORONTO, MONTREAL

BETTER DRAINAGE
FOR INCREASED PRODUCTION AND REDUCED STEAM COSTS

EFFICIENT PERFORMANCE
TROUBLE-FREE OPERATION
LONG LIFE SERVICE
NEGLIGIBLE MAINTENANCE
LOW COST INSTALLATION

1. Straight-in-Line Installation reduces installation cost. 2. Internal By-Pass eliminates air and gases with discharge of condensate, giving trap approximately four times air handling capacity of standard traps. 3. Internal Strainer prevents foreign particles from clogging traps. 4. No Thermal Elements or Diaphragms. 5. No Levers, Hinges or Toggling to get out of order and create repair bills. 6. Location of valve seat at TOP of trap prevents most troubles caused by scale, sand and dirt. 7. Nut at top of trap is part of valve seat and, given a slight turn, allows trap to by-pass. 8. Valves rotate with buckets, as traps discharge, automatically regrinding valves and seats. 9. Buckets (open floats) float with full half-inch of water maintaining constant and positive water seal against steam. 10. Body of traps removed without taking traps from lines. 11. Capacity range, 500 lbs. to 3,000 lbs. an hour. 12. Operate at pressures from 0 to 125 lbs. and up to 250 lbs. depending on size of trap.



BETTER STEAM CONTROL

Stickle Reducing and Regulating Valves are especially designed to work in systems where exacting control is essential. They are "tailored" to meet specific operating conditions, and are sensitive, accurate and positive in operation.

Stickles Series 400, single-seated valves, in pipe sizes from ¾" to 4", offer these distinct advantages in addition to their superior performance: Interchangeability of all internal parts. Independent regrinding of main valve and pilot valve and seat. Repair at point of use. Complete description and specifications in Bulletin No. 435. Stickle Series 200 Valves, are double seated, semi-balanced, and made in small to large pipe sizes. Three types: Lever and Weight, Diaphragm Operated, Spring Loaded, Diaphragm Operated and Pilot Operated. Bulletin No. 235 supplies detailed descriptions and specifications.

• Stickles Series 100 Steam Traps supply the complete drainage service required for ideal steam trap performance. They assure maximum operating efficiency for processing units and other equipment using medium and high pressures, requiring traps with capacities of 500 lbs. to 3000 lbs. per hour. ***Ask for Bulletin No. 115.***

LARGE CAPACITY, HIGH PRESSURE TRAPS

• If traps of greater capacity are required, Stickle Series AE, embracing seven trap sizes, affording a capacity range of 5000 lbs. to 21,000 lbs. per hour, will better meet your requirements. In addition to the recognized advantages supplied by Stickle design and construction, traps in this series have four times the capacity of standard traps of comparable size. ***Ask for Bulletin No. 315.***

LOW PRESSURE TRAPS, ANY CAPACITY

• Stickle Series T Steam Traps afford a trap style and size for any service or capacity, for equipment operating at low pressure, or for use in connection with vacuum systems or vacuum pumps. ***Ask for Bulletin No. 415.***

STICKLE
STEAM SPECIALTIES COMPANY
2265 Valley Avenue, Indianapolis, Indiana
SPECIALIZING FOR 35 YEARS IN REDUCING THE COST OF STEAM

man & Howard, 89 Broad St, Boston, Mass., engrs.

New Jersey—Industrial Co plans, by Albert Kahn, Inc, archt and engr, 345 Centre Bldg, Detroit, Mich., constructing plant. Defense Plant Corp will finance. $26,000,000.

New Mexico—U S Eng, Albuquerque, plans constructing improvements. Over $5,000,000.

N. Y., Brooklyn—Brooklyn Edison Co, Inc, 380 Pearl St, plans constructing 4- and 5-story, electric switch house alterations, addns, 168 Marshall St. $300,000.

N. Y., Depew—U S Eng, 120 Wall St, New York, plans constructing plant. $1,400,000 incl equip. Backus, Crane & Love, 360 Delaware Ave, Buffalo, engrs.

N. Y., Greenport—Federal Works Agency, 2 Lafayette St, New York, plans constructing 250,000-gal elevated storage tank, pump plant, well, 2 driver-pumps, mains, $98,081. FWA

Ohio—Industrial company plans constructing factory addn, $10,000,000. Federally financed. Albert Kahn & Associates, 345 New Center Bldg, Detroit, Mich, engrs.

Ohio, Cleveland—Pump Engineering Serv Corp, c/o B Eyman, 12910 Taft Ave, plans constructing plant. $2,500,000. Defense Plant Corp will finance.

Ohio, Cleveland—White Motor Co, R F Black, Pres, 842 E 79 St, plans constructing boiler house. $100,000. H R Hadlow, 700 Prospect Ave, engr.

Ohio, Napoleon—City plans imprv light and water plant, new turbine. $187,000.

Oklahoma—Co-operative Refiners, Duncan, plans construction plant $1,500,000. Defense Plant Corp will finance.

Oklahoma—Grand River Dam Auth, Box 672, Vinita, rejected bids Apr. 1, constructing substation extens, Tulsa, Markham Ferry, Pensacola Dam and Riverbank, transmission line extens. $300,000. W R Holway, Box 672, Vinita, engr.

Okla., Choteau—City plans constructing pump station, filter plant, W W exten, Docket, Okla, 34-133. $277,000. FWA. Clonts & Morgan, Muskogee, engrs.

Oregon—Electric Steel Rolling Mills, M Schmitzer, 3330 N W Yeon St, Portland, plans constructing electric steel rolling mill. $100,000. Defense Plant Corp will finance.

Oregon—Rustless Iron & Steel Corp, 3400 E Chase St, Baltimore, plans constructing plant. $1,000,000. Defense Plant Corp will finance.

Oregon and Washington—Bids May 13, by Bonneville Power Admin, P O Box 3537, Portland, Ore., furnishing one current-limiting resistor each for substations at Salem, Ore., Vernita, Ampere and Covington, Wash., Inv. 2777.

Oregon and Washington—Bids May 14, by Bonneville Power Admin, P O Box 3537, Portland, Ore., carrier current pilot relay equip and carrier current telephone equip for substations at Eugene, Astoria, Pendleton and Albany, Ore., Ampere, Colfax, Ellenburg, Walla Walla, Napavine, Covington, Mead and Odair, Wash., Inv 3670.

Ore., Salem—Bonneville Power Admin, P O Box 3537, Portland, plans constructing substation addns $183,000.

Pennsylvania—Industrial co bids soon general contract construction plant. Less than $1,000,000. Defense Plant Corp will finance. R J Brocker, 201 Coulter Bldg, Greensburg, Pa., archt, Hunting, Davis & Dunnells, Century Bldg, Pittsburgh, Pa., engrs.

Pennsylvania—National Malleable & Steel Castings Co, Sharon, receiving bids constructing plant. $1,500,000 with equip. Defense Plant Corp will finance.

Pennsylvania—Superior Steel Products Corp, 14 St, Monaca, revising plans constructing plant. $1,000,000. Defense Plant Corp will finance.

Pennsylvania—U S Eng, Chimes Bldg, Syracuse, N. Y., rejected bids Apr 7, constructing improvements. To exceed $5,000,000.

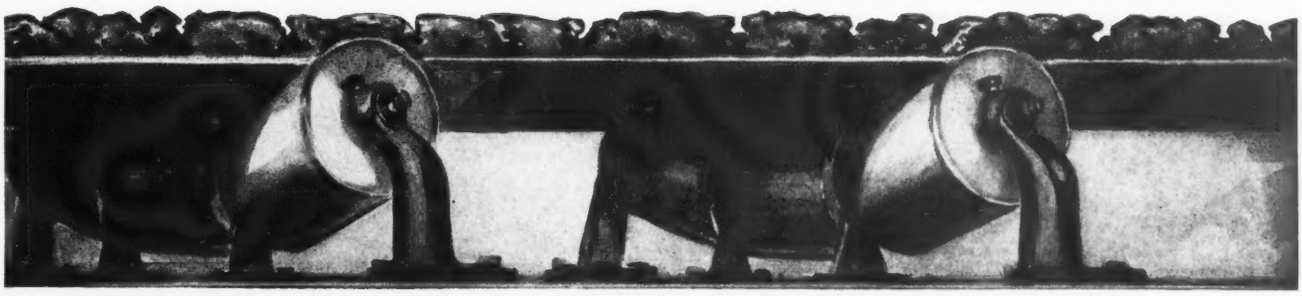
South Carolina—Bids May 20, by U S Eng, Camp Croft, constructing alterations addns, cold-storage plant, CE 2034-42-2808.

Tennessee—Bids May 11, by industrial company, constructing superstructure, factory. Less than $1,000,000. Federally financed. W J Knight Co, Wainwright Bldg, St. Louis, Mo., engrs.

Tennessee—Bids May 14, by U S Eng, Federal Bldg, Nashville, constructing imprvs bldgs. Over $5,000,000. Warfield & Keeble, Nashville Trust Bldg, Nashville, archts.

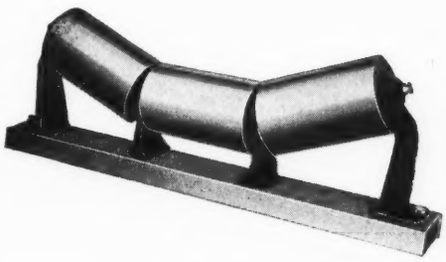
Texas—Neches Butadiene Products Co, plans constructing plant. $72,000,000 De-

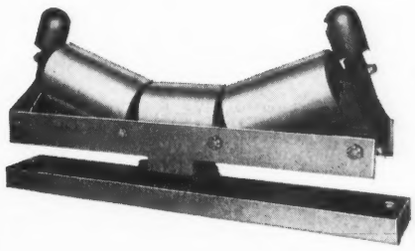
YOUR CONVEYOR BELT!



Keep it *Keep it* *Keep it*

GOING...STRAIGHT...CLEAN





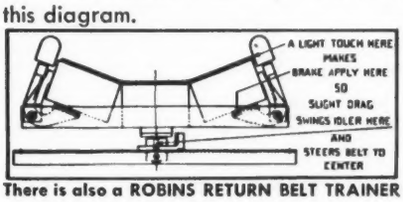
WHEN?—all the time there's work to do. Because you want to get your share of increasing 1941 business. **ROBINS ANTI-FRICTION TROUGHING AND RETURN IDLERS** are designed and constructed to outlast other idlers. They are widely known for the following high-grade features:

1. Rigid truss construction.
2. Complete identical pulley assemblies, interchangeable and reversible.
3. Improved "Single-Shot" lubrication.
4. "Triple Seal" that keeps grease in and dirt out.

You get maximum service and minimum maintenance with

WHY?—because belting is the most expensive item in a conveyor installation and its premature destruction is a serious, inexcusable waste.

ROBINS BELT TRAINERS are not "guide idlers." A belt controlled by **ROBINS** Trainers is aligned *without wear;* not by pressure on the edges but by rolling contact with the entire surface of the belt. Notice the way it works in this diagram.



There is also a ROBINS RETURN BELT TRAINER

HOW?—with ROBINS RUBBERDISC RETURN IDLERS. The rubber discs of these idlers are made of a soft abrasion-resisting rubber which slightly flattens at the points of contact with the belt. These deformations afford a constant automatic cleaning action for both discs and belt. Result—no accumulation of sticky abrasive or corrosive substance on the belt which means longer belt life and less maintenance. This Idler is equipped with ball bearings completely sealed and lubricated for life. No greasing or oiling is required.

ROBINS
ANTI-FRICTION TROUGHING AND RETURN IDLERS

ROBINS
TRAINING IDLERS

ROBINS
Rubberdisc
RETURN IDLERS

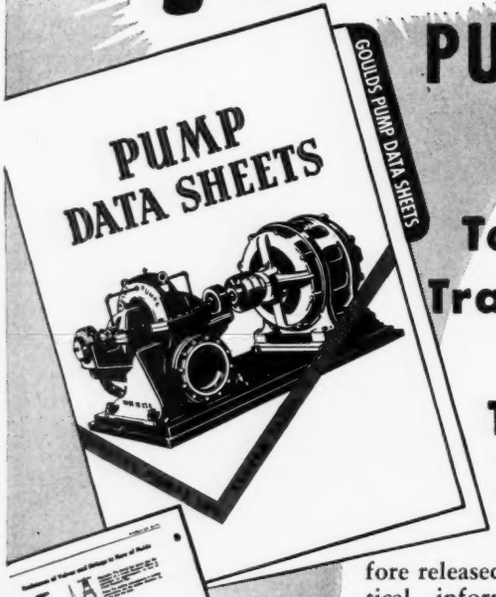
ROBINS CONVEYING BELT COMPANY PASSAIC, NEW JERSEY

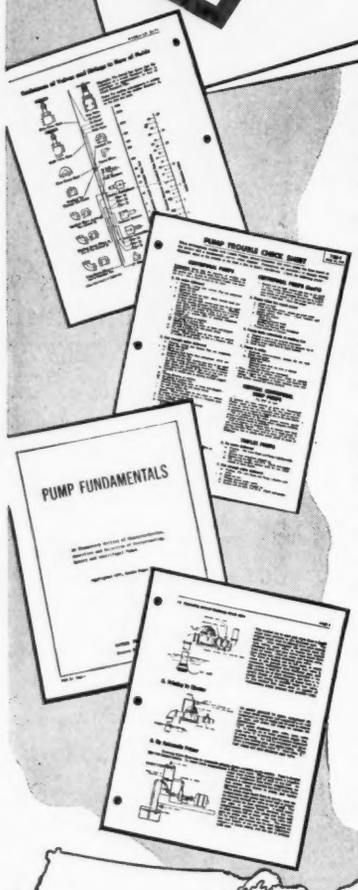
BOSTON • CHARLESTON, W. VA. • CHICAGO • CLEVELAND • DETROIT • NEW YORK • PHILADELPHIA • PITTSBURGH • SAN FRANCISCO

FREE

PUMP DATA SHEETS

To Help You Train New Men For Their Jobs





To help pump operators through the Emergency, Goulds now offers these Pump Data Sheets, never before released, containing a wealth of practical information on pump selection, installation, operation and maintenance—diagrams, tables, formulae, charts and down-to-earth, helpful tips.

While much of this material is elementary—and hence ideal for acquainting inexperienced men with their new jobs—some of it is highly technical, to help you get the most from your present pumping equipment and select new pumps wisely.

Just clip the coupon and mail to Goulds, Dept. F. You will receive, absolutely free, a complete set of six sheets in a convenient binder. After you have looked them over, request as many free copies as you wish of any individual sheets or of the complete binder.

These sheets were originally prepared for the confidential information of Goulds own salesmen. Some of them contain material that would ordinarily not be made public. But we believe that in these times we owe it to our country and our customers to make available every bit of information that will help users of pumps.

GOULDS SERVICE
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GOULDS PUMPS INC.
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Please send free and without obligation one Pump Data Sheet Binder. It is understood I may request additional free copies of binder or individual sheets.

Name_____ Title_____

Company_____

Address_____

City_____ State_____

2475B

fense Plant Corp, will finance.

Texas—Republic Oil & Refining Corp, Texas City, receiving bids constructing plant, etc. $7,000,000. Defense Plant Corp will finance.

Texas, Bellville—American Creameries & Cold Storage Co, c/o Creamix Corp, 737-11 St, Houston, plans constructing cold-storage plant. $50,000.

Texas, Port Arthur—Texas Co, 720 San Jacinto St, Houston, soon lets contract constructing lubricating oil mfg plant, etc. $2,500,000.

Vt., Brattleboro—American Optical Co, 14 Mechanic St, Southbridge, Mass, receiving bids 1 story, brick, steel grinding bldg, 17x20 ft pump house 61x90 ft power house and garage. Over $50,000 incl equip. M A Dyer Co, 8 Beacon St, Boston, Mass., archts. Hayden, Harding & Buchanan, Park Sq Bldg, Boston, Mass., engrs.

Wash., Longview—Bids May 1, by Bonneville Power Admin, P O Box 3537, Portland, Ore., furnishing metalclad switchgear for substations, Inv 2753.

Wash., Seattle—E R Hoffman, city light supt, City Light Bldg, plans raising height Ross hydroelectric dam. $8,300,000. City Council considering proposal of Light Dept for issuance and sale of bonds to finance project, without federal aid.

Contracts Let

Arizona—U S Eng, Albuquerque, N. M., awarded contract constructing plant to Guy F Atkinson, Russ Bldg, San Francisco, Calif.

California—Aluminum Co of America, 5151 Alcoa Ave, Vernon will construct plant addns own forces. $826,000.

California—Industrial co awarded contract constructing plant to O J Senum, 2646 20 St, Santa Monica, $4,000,000. Taylor & Taylor, 803 W 3 St, Los Angeles, archts and engrs.

California—U S Eng, Wright Bldg, Sacramento, awarded contract constructing imprvs, buildings, to L Franceschi, 465 Avila St, San Francisco, approx $1,300,000.

Calif., San Diego—Cudahy Packing Co, 803 E Macy St, Los Angeles, awarded contract reconstructing packing plant, constructing power house to Myers Bros, 3407 San Fernando Rd, Los Angeles $400,000.

Georgia—Industrial company awarded contract constructing improvements for Govt agency to Daniel Const Co, Greenville, S. C., $6,500,000.

Georgia—U S Eng, Post Office Bldg, Savannah, awarded contract constructing buildings. Inv 819-42-179, to Farquhar McRae, 1201 E 33 St, Savannah. Under $1,000,000.

Idaho—U S Eng, Pittock Blk, Portland, Ore., awarded contract constructing electrical service and dist sys, Inv 522, to Lessinger Plumbing & Heating Co, 221 S 10 St, Boise.

Idaho—Yards & Docks, Navy Dept, Wash., D. C., awarded contract constructing improvements to Walter Butler Contg Co, 1030 Minneapolis Bldg, St. Paul, Minn. Est $31,000,000.

Illinois—U S Eng, 816 U S Courthouse & Customhouse, St. Louis, Mo., awarded contract constructing plant to V Jobst & Sons, Lehmann Bldg, Peoria. Est $25,000,000. Industrial company will operate. Allen & Kelley, 435 Architects & Bldrs Bldg, Indianapolis, Ind., archts.

Indiana—Industrial company awarded contract constructing plant, etc, to National Concrete Fireproof Const Co, Citizens Bldg, Cleveland, O. Est $2,000,000. Federally financed. Allen & Kelly, Architects & Builders Bldg, Indianapolis, archts.

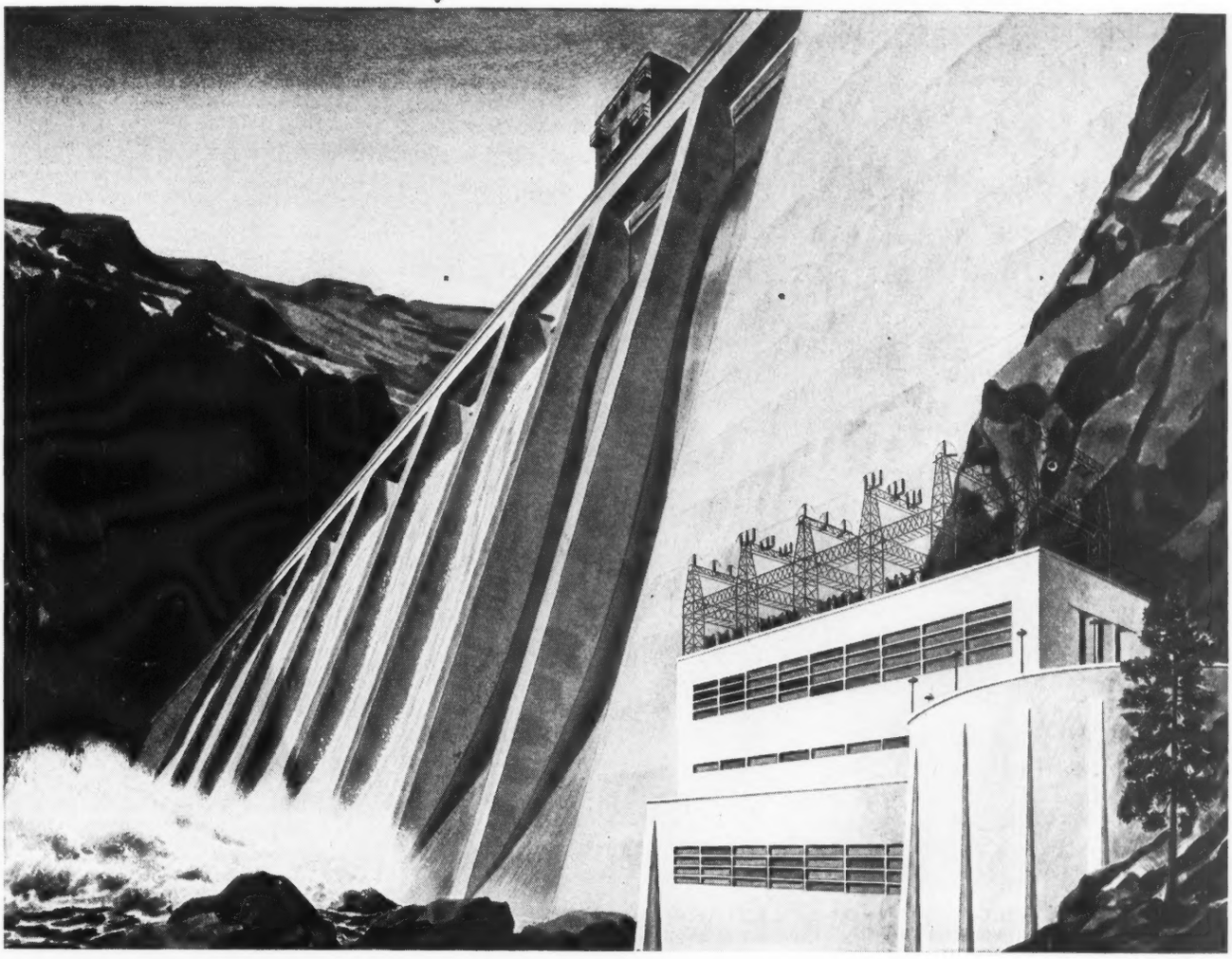
Indiana—U S Eng, Federal Bldg, Louisville, Ky., awarded contract constructing and management services, plant, to Ryan Constr Corp, Furniture Bldg, Evansville. $20,000,000.

Indiana—U S Eng, 612 Federal Bldg, Louisville, Ky., awarded contract constructing mfg plant A-E-M to Russ & Harrison, 1001 Architects Bldg, L Colvin, 507 Pd Trade Bldg, and William E Mohler Co, 714 Union Title Bldg, all of Indianapolis. Over $5,000,000.

Indiana—U S Eng, 932 Post Office Bldg, Chicago, Ill, awarded contract constructing temporary construction mfg plant. A-E-M to A S Alschuler & R N Friedman, 28 E Jackson Blvd, Chicago, Ill. and J W Snyder Co, 307 N Michigan Blvd, Chicago, Ill. Over $5,000,000.

Indiana—War Dept, 20 St and Constitution Ave N W, Wash., D. C., awarded contract constructing plant, to C M

Looking ahead with Asbestos



For one answer to Tomorrow's problems in electrical control . . . look to K&M Ebonized Asbestos

As an insulating material for the mounting of electrical apparatus, K&M Ebonized Asbestos has already proved to be in a class by itself. In switchboards, panels and testing tables, it withstands shock, vibration and temperature change like no other known material. It is able to withstand high voltages without being punctured. The chances are that the tremendous dielectric strength and uniform density of this product are even now increasing the dependability of your own house lighting.

Due to the prior claims of war, K&M's Ebonized Asbestos cannot be available to everyone until peace returns. Meanwhile, our research laboratories, seeking to expand the usefulness of asbestos, would be glad to study any problems of yours, with the hope that this strange mineral may prove to be the answer.

* * *

Nature made asbestos;
Keasbey & Mattison, America's asbestos pioneer, has made it serve mankind . . . since 1873.

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COMPANY, AMBLER, PENNSYLVANIA

Makers of

asbestos-cement shingles and wallboards; asbestos and magnesia insulations for pipes, boilers, furnaces; asbestos textiles; asbestos electrical materials; asbestos paper and millboard; asbestos marine insulations; asbestos acoustical material; asbestos packings; asbestos corrugated sheathing and flat lumbers; asbestos-cement pipe for water mains.

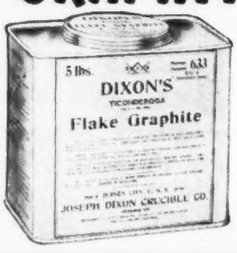
Lost hours are lost production!

FOR MORE PRODUCTION WITHOUT MORE MAN HOURS

SAVE maintenance hours—STRETCH bearing surface life—with extra protective film built up by DIXON'S TICONDEROGA Flake Lubricating Graphite. There's a need NOW, more than ever, for this enduring lubricant.

Use alone or in greases to supplement or supplant ordinary lubrication where extremes of temperature, pressure, speed, moisture make ordinary lubrication insufficient.

DIXON'S FLAKE GRAPHITE



Available in two particle sizes: No. 1—large, unctuous, lustrous flakes; No. 2—finely powdered flakes. For close-fitting bearings, Dixon's No. 635—minutely subdivided, powdered flakes smaller than No. 2.

GRAPHITE EXCELLENCE SINCE 1827

JOSEPH DIXON CRUCIBLE COMPANY, JERSEY CITY, N. J.

Ticonderoga Graphite • No. 635 Graphite • Microfyne Graphite • Pipe Joint Compound • Graphite Seal • Graphited Oils • Cup and Pressure Gun Grease • Gear Lubricants • Waterproof Graphited Grease • Auto-Marine Grease • Graph-Air Guns • Belt Dressing (Contains no Graphite).

SP 2230

Ceupel Constr Co, Indianapolis. Est exceeds $1,500,000. Giffels & Valet, Inc, 1000Marquette Bldg, Detroit, Mich., archts.

Indiana—Yards & Docks, Navy Dept, 18 St and Constitution Ave, N W, Wash., D. C., awarded contract constructing improvements to J L Simmons Co, Inc, Decatur, Ill., and United Const Co, Winona, Minn., $4,700,000. Russell B Moore & Co, Inc, 1456 N Delaware St, Indianapolis, consult engrs.

Kansas—U S Eng, 601 Davidson Bldg, Kansas City, Mo., awarded contract constructing mfg plant. A-E-M to William S Lozier, 10 Gibbs St, Rochester, N. Y. and Broderick & Gordon Constr Co, W Alameda and Kipling Sts, Denver, Colo. Over $5,000,000.

Massachusetts — Industrial company awarded contract constructing shop, etc, to Hughes-Foulkrod Co, 1505 Race St, Phila., Pa. $2,070,000 Federally financed.

Massachusetts—U S Eng, Park Square Bldg, Boston, awarded contract constructing plant to Morton C Tuttle Co, 682 Park Square Bldg, Boston, Est $5,000,000. Lockwood Greene Engineers, Inc, 10 Rockefeller Plaza, New York, N. Y., archts.

Michigan—Industrial co awarded contract constructing plant, to Austin Co, 429 Curtis Bldg, Detroit. Est $20,000,000. Defense Plant Corp will finance.

Mississippi—U S Eng, 409 U S Courthouse & Customhouse, Mobile, Ala., awarded contract constructing plant, to H K Ferguson Co, Hanna Bldg, Cleveland, O., and Oman Constr Co, Acklen Park, Nashville, Tenn. Over $5,000,000.

Nebraska—U S Eng, 1709 Jackson St, Omaha, awarded contract constructing electrical work for plant to Commonwealth Electric Co, 417 Bway, St. Paul, Minn. Est approx $500,000.

Nebraska—U S Eng, 1709 Jackson St, Omaha, awarded contract constructing 2nd section plant, to Hagstrom Constr Co, 610 New York Bldg, St. Paul, Minn. and Parson Constr Co, 701 N 20 St, Omaha, Nebr.; water supply to Layne-Western Co, B M A Bldg, Kansas City, Mo.; railroad to Inland Constr Co, 3867 Leavenworth St, Omaha.

Nevada—Industrial company awarded contract constructing plant to P J Walker Co, 660 Market St, San Francisco, Calif., approx $16,000,000. Defense Plant Corp will finance.

New Jersey — Industrial company awarded contract constructing plant addn to Thompson Starrett Co, Inc, 444 Madison Ave, New York, N. Y. Est under $1,000,000. Defense Plant Corp will finance.

New Jersey — Industrial company awarded contract constructing 1 and 2 story, 1400x2000-ft plant, to Mahony-Troast Constr Co, 657 Main Ave, Passaic, $5,000,000. Albert Kahn & Associates, 345 New Center Bldg, Detroit, Mich., archts and engrs. Defense Plant Corp will finance.

New Jersey—U S Eng, 6 and Walnut Sts, Phila., Pa., awarded contract constructing addnl facilities to E F Verga, Inc, Bway and Cooper Sts, Camden. Est $1,000,000.

N. J., Bellmar—Boro awarded contract constructing sewage disposal treatment plant, pump sta Docket N. J. 28-114, to Rice & Weidman, Lancaster, Pa. $116,725 FWA.

N. Y., Buffalo—Industrial company awarded contract constructing mfg bldg, 3 craneways, office bldg, powerhouse and cafeteria to Turner Const Co, 420 Lexington Ave, New York. Est $4,000,000. Federally financed. T H McKaig, 505 Delaware Ave, Buffalo, archt and structural eng. Beman & Candee, 374 Delaware Ave, Buffalo, mechanical engr.

North Carolina — Industrial company awarded contract constructing plant addn to H Frank Mitchell, Burlington. Federally financed.

Ohio—Atmospheric Nitrogen Corp, 61 Bway, New York, N. Y., will construct plant for War Dept, own forces. Over $10,000,000.

Ohio—Industrial company awarded contract constructing plant to Melbourne Bros Constr Co, 2100 Woodland Ave N W. Est under $1,000,000.

Ohio, Avon Lake—Cleveland Electric Illuminating Co, W H Hartman, purch agt, 75 Public Sq, Cleveland, awarded contract constructing brick, steel, concrete power plant addn to Hunkin-Conkey Constr Co, Cleveland. Est bldg $500,000, complete $2,500,000. E Rhoades, 75 Public Sq, Cleveland, engr.

• Another advertisement telling how different American industries are speeding up wartime production •

We've got to keep giving him 13 EXTRA *to win the war*

Taylor Instruments are helping America's planes fly farther faster...

▶ We'll win this war in the air. We'll win it because our planes are powered by the world's best gasoline.

Our planes use high-powered, 100-octane gasoline. Our enemies depend on gasoline which averages 87-octane. This 13-point lead gives an American pilot ⅓ more power from his fuel than his opponent gets. Our boys can climb out of anti-aircraft fire 40% faster . . . fly higher than enemy planes of the same weight . . . get off the ground one-fifth faster. Our 100-octane gas reduces the fuel load so our bombers can carry 20% to 30% more bomb load, or fly farther with heavier armament.

We've got to "fill 'er up" for ourselves and our allies with three times as much 100-octane aviation gasoline as we're producing now—increase production to 5 million gallons a day! We can. We're going to. We're doing it. Taylor Instruments are helping the speed-up.

From pilot plants through commercial plants, Taylor Instruments and Taylor engineers have been a vital help in producing high-octane gasoline. Now *every* gasoline refiner considers instruments essential. Taylor Instruments insure precision processing—automatically accurate and constant control of complicated chemical and physical reactions—complete, dependable uniformity—lower operating costs—more, *better* production.

With Taylor Instruments indicating, recording and controlling temperatures, pressures, liquid levels, rates of flow in all the perplexing, exacting refining operations, America's great oil industry *is* producing the high-grade gasoline and lubricating oil we need—and *can* produce more . . . *more* . . . MORE!

Uncle Sam and our allies are relying on Taylor Instruments to help produce:

100-OCTANE AVIATION GASOLINE
. . . in plants of the biggest producers of this type of fuel.

HIGH-GRADE LUBRICATING OIL
. . . in plants producing the quantities needed by tanks, cars, planes.

BETTER ASPHALT
. . . in plants furnishing this "quick take-off" surfacing for airfield runways and highways.

Without help from the oil industry, America couldn't win the war. Without the aid of automatic control instruments of the types made by Taylor, the oil industry couldn't hope to do its staggering job. Without Taylor Instruments, many another American industry could never have speeded up victory production. Are Taylor Instruments helping you do *your* war work? Have you called in Taylor engineers, to suggest ways of *getting more* out of your present equipment? Are you really tuned up to turn it out? Taylor Instruments will help you *now*—America needs you *now*. Taylor Instrument Companies, Rochester, N. Y., and Toronto, Canada. Makers of the famous "Not 1 but 5" Fulscope Controllers.

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★ ★ ★ HELP BEAT 'EM BY BUYING U. S. DEFENSE BONDS ★ ★ ★

Supervised Boiler and Condenser Cooling System Protection at Moderate Cost!

We believe the true answer to your boiler water and condenser cooling system problem lies in competent supervision of water conditions by experts plus a simplified natural method of water correction.

Our new Technical System does just that! Scheduled supervision and treatment based on frequent water analysis finds and remedies your trouble . . . specific organic formulas developed individually to fit your needs provide a simplified, natural correction. Send the coupon below for the new Technical System bulletin or have a Water Treatment Company engineer inspect your plant without obligation.

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WATER TREATMENT COMPANY of America
1129 HODGKISS STREET · PITTSBURGH, PA.

Oklahoma—Federal Works Agency, 18 and F Sts, N W, Wash., D. C., c/o D G Wright, Vinita, awarded contract constructing substation extens for Grand River Dam Auth, P O Box 672, Vinita, to Elliott Constr Co, 527 Sunderland Bldg, Omaha, Nebr., $320,495.

Oregon and Washington — Bonneville Power Admin, P O Box 3537, Portland, Ore., awarded contract furnishing synchronous condensers for substations, Portland, Ore., Covington, Spokane and Ampere, Wash., Inv, 2595, to Westinghouse Electric & Mfg Co, East Pittsburgh, Pa., $872,380.

Pennsylvania — Industrial company awarded contract constructing plant to Henry Shemk Co, 1115 Sassafrass St, Erie, Pa. Less than $1,000,000. Meyers & Johnson, 821 Commerce Bldg, Erie, archts.

Pennsylvania — Industrial company, awarded contract constructing plant to Ferguson & Edmondson Co, Keystone Bldg, Pittsburgh, Pa. Est over $5,000,000. Defense Plant Corp will finance.

Pennsylvania — Industrial company, awarded contract constructing nine plant bldgs, to J L Stuart, 518 Oliver Bldg, Pittsburgh, and Mellon-Stuart Co, 210 E. Parkway N S, Pittsburgh; structural steel fabrication and erection to Bethlehem Steel Co, Oliver Bldg, Pittsburgh, over $5,000,000, cost plus fixed fee basis. Defense Plant Corp, will finance. P F Loftus, 632 Oliver Bldg, Pittsburgh, engr.

Pennsylvania — McConway & Torley Corp, 48 St and AVRR Co, Pittsburgh, awarded contract constructing mfg plant, incl two cranes to Paugh & Brown Inc, 6007 Euclid Ave, Cleveland, O.; structural steel, to Fort Pitt Bridge Wks, Bulkley Bldg, Cleveland, O. Est $1,000,000. Federally financed. O D Conover, 1740 E 12 St, Cleveland, O., engr.

Pennsylvania—Pittsburgh Steel Co, H D Williams, pres, Grant Bldg, Pittsburgh, awarded contract constructing mfg plant to Freyn Engrg Co, 310 S Michigan Ave, Chicago, Ill. Est over $5,000,000. Federally financed.

Pennsylvania—War Dept, 20 St and Constitution Ave N W, Wash., D. C., awarded contract constructing manufacturing plant to H Platt Co, 902 Raspberry St, Erie. Est over $5,000,000.

South Dakota—War Dept, 20 St and Constitution Ave, N W, Wash., D. C., awarded contract constructing plant to J A Terteling & Sons, Robert Noble Bldg, Boise, Idaho.

Texas, Belleville—American Creameries & Cold Storage Co, c/o Creamix Co, 737 11 St, Houston, will construct cold-storage plant. Owner builds $40,000.

Texas, Conroe—Superior Oil Co, Conroe, awarded contract constructing gasoline refinery, to Fluor Corporation, Ltd, Esperson Bldg, Houston. $2,800,000.

Washington—Bonneville Power Admin, P O Box 3557, Portland, Ore., awarded contract for oil circuit breakers for substations, Inv 2630, to Westinghouse Electric & Mfg Co, East Pittsburgh, Pa., $456,075; to Allis Chalmers Mfg Co, 1126 S 70 St, Milwaukee, Wis., $226,133; to General Electric Co, 1 River Rd, Schenectady, N. Y. $231,350. Grand total $913,558.

Washington—Bureau Reclamation, Custom House, Denver, Colo., awarded contract for ten transformers for Grand Coulee Power Plant. Columbia Basin Project, Spec 1025 to Westinghouse Electric & Mfg Co, East Pittsburgh, Pa. $882,610.

Washington — Industrial company awarded contract for design and construction plant to H K Ferguson Co, Hanna Bldg, Cleveland, O., Total est $20,000,000.

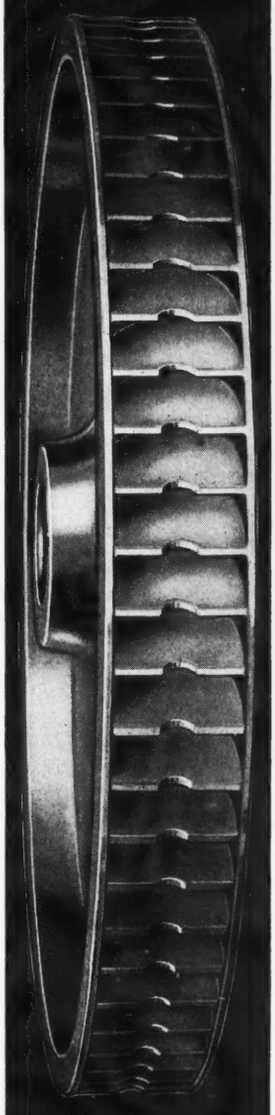
Wash., Tacoma—A M Angove, clk Bd Contr & Awards, City Hall awarded contract constructing two concrete dams, two power houses for second Nisqually power development to L E Dixon Co, 609 S Grang Ave, Los Angeles, Calif. $5,964,384.

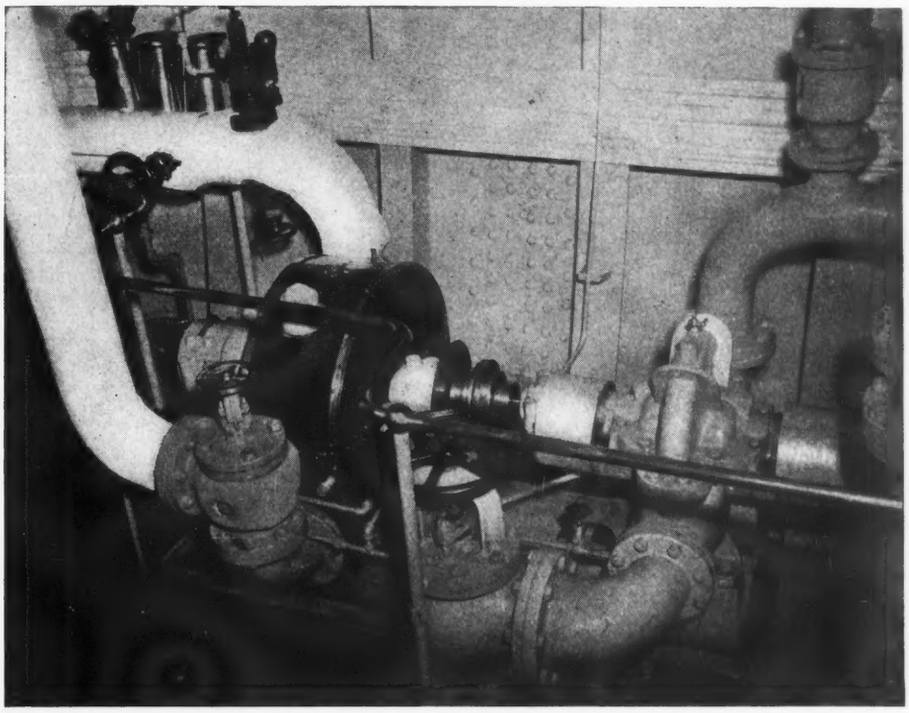
West Virginia—Defense Plant Corp, 811 Vermont Ave, N W, awarded contract constructing plant to Ford, Bacon & Davis, Inc, 39 Bway, New York, to exceed $5,000,000. Industrial company will operate.

Wisconsin—U S Eng, Post Office, St. Paul, Minn., awarded contract constructing plant, to Fox Valley Constr Co, Appleton, and Weitz Co, 713 Mulberry St, Des Moines, Ia. To exceed $5,000,000.

Wisconsin—U S Eng, 408 Federal Bldg, Milwaukee, awarded contract constructing plant, to Hutter Constr Co, 134 Western Ave, Fond du Lac, and to Massman Constr Co, 20 W 9 St, Kansas City, Mo. To exceed $5,000,000. Smith, Hinchman & Grylls, Inc, 800 Marquette Bldg, Detroit, Mich. and J Donohue Eng Co, 608 N 8th St, Sheboygan, archts and engrs.

TERRY





Above — 50 H. P. Terry Solid Wheel Turbine driving Fire and Sanitary Pump on recently completed merchant ship. Steam condition: 450 lbs. 750° TT. - 10 lbs.

FOR AUXILIARY DRIVE — THE TERRY SOLID WHEEL TURBINE OFFERS MANY ADVANTAGES

FROM THE SMALLEST TO THE LARGEST, THESE RELIABLE TURBINES HAVE —

- ★ Indestructible one piece wheel.
- ★ Large radial and axial clearances.
- ★ Double rim protected blading.
- ★ Individual nozzle control.
- ★ Dependable and durable governor.
- ★ Heavy dust-proof bearing and governor housing.
- ★ Independent overspeed trip with separate valve.
- ★ Sturdy casing design.
- ★ Stong and easily inspected steam strainer.
- ★ Truly accessible construction, which makes inspection of the interior parts a simple matter.

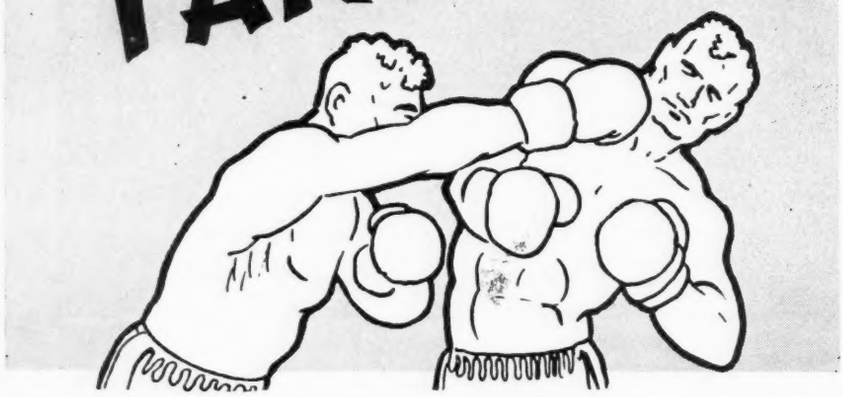
FOR FULL DETAILS ASK FOR BULLETIN S-116.

T-1148

THE TERRY STEAM TURBINE COMPANY
TERRY SQUARE, HARTFORD, CONN.

ECLIPSE AVIATION
SEAMLESS FLEXIBLE
METAL HOSE
..... CAN

DISH IT OUT AND TAKE IT!



★IN DIESEL EXHAUST APPLICATIONS

Eclipse Seamless Hose resists the heat and the punishment that play havoc with other types of exhaust outlets.

★IN BOILER TUBE CLEANER HOSE

Eclipse Seamless Metal Hose has the flexibility of rubber *but* has the ability to withstand the rough wear from tube edges.

★IN COMBUSTION UNIT FEED LINES

that are subject to vibration, heat, expansion and contraction, Eclipse Seamless Metal Hose has proven its stamina.

★IN MANY OTHER APPLICATIONS

such as flexible connections, lubricating oil lines, vibration eliminators, etc., Eclipse Hose is useful in carrying all kinds of liquids and gases, and in a wide variety of other applications.

DATA

Monel hose stocked in sizes from ⅛" to 2" I.D.

Steel hose can be produced with I.D up to 40".

In addition to Monel, other alloyed tube stock can be obtained.

Eclipse Metal Hose is made in two degrees of pitch, normal and close. Also available with outer jackets of wire braiding or spiral metal.

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ECLIPSE AVIATION
SEAMLESS FLEXIBLE
METAL HOSE

Manufactured and sold by
BENDIX AVIATION CORPORATION
PHILADELPHIA, PA.

Power Lines

(*Continued from page* 128)

OBITUARIES

HENRY P CURTISS, 67, New England representative of the Baltimore heating and ventilating engineering house of Flynn & Emrich, died at Boston hospital on April 9. He was a native of Buffalo, N. Y., and a graduate of Cornell University.

JOHN J ROGERS, engineer of the Rhode Island School of Design, Providence, and formerly plant engineer of the Manufacturers' Building in that city, died at West Barrington, R. I., April 9. For some time he was also an engineer for the New Haven Railroad.

PERCY CHILD IDELL, 63, for many years New England manager for the Babcock & Wilcox Co., with offices at Boston, and one of the best known power plant engineers of the North-

east, died suddenly at his home in Brookline, Mass., on April 13. Mr Idell was born in Hoboken, N. J., and was graduated from Stevens Institute of Technology in 1899. He joined the B & W railway soon after obtaining his diploma, and remained with it until the close of his life.

JAMES A CRANSTON, 80, who retired in 1938 as commercial vice-president of the General Electric Co after 49 years of active service on the Pacific Coast, died April 15 at his home in San Francisco, Calif. Mr Cranston first began selling electricity and electrical equipment in the spring of 1889 for the old Northwest Thomson-Houston Co at St. Paul, Minn. He played an important role in making the West electrical. Shortly after the Thomson-Houston Co became a part of the General Electric Co in 1892, Mr Cranston became manager of the Northwest territory with headquarters in Portland, Ore. It was in the two decades following this year

Our Job for 1942

"Our" means Youngstown and all its customers

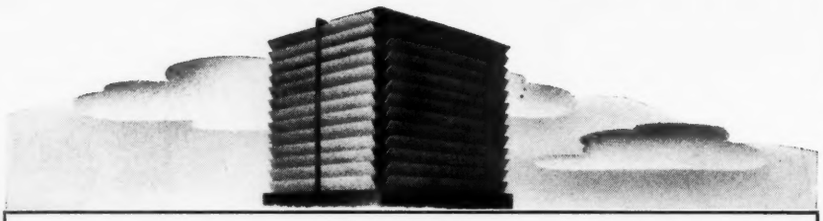
Work will win this war. Every possible pound of ore must be mined and transported to the furnaces, every possible pound of steel poured from open hearths and Bessemers. Equipment and men will continue to work night and day for Victory.

Where does this steel go? To fabricators who will convert it into material which will be used to win this war. Their equipment and men will work night and day, for Victory.

When we free Americans are willing to work to the limit of our capacity, our triumph over the dictator-driven workers of our enemies will be sure.

THE YOUNGSTOWN SHEET AND TUBE COMPANY
YOUNGSTOWN, OHIO

25-35E



How to Save Strategic Chemicals and Still Control Slime and Algae

By JOHN D. FLEMING, Sales Development Department
MONSANTO CHEMICAL COMPANY

SANTOBRITE (sodium pentachlorophenate), the effective and highly efficient algaecide and bactericide developed by Monsanto for the control of slime and algae in industrial cooling-water systems, is still available for that purpose.

Supplies of both phenol and chlorine, however, the raw materials from which Santobrite is manufactured, are critically tight, and it is essential that the most efficient possible use be made of every ounce of Santobrite.

Experience has indicated that under practical conditions, about 20 parts per million of Santobrite will give good control of the slime and algae formations which otherwise build up on heat transfer surfaces to the great detriment of operating efficiency. The exact dosage for your particular cooling-water system, however, depends on the types of organisms found in your system, the extent of contamination and environmental factors.

To determine the smallest dosage you can use and still keep your heat transfer surfaces film-free, the following steps are recommended:

1. Establish in the circulating water system a concentration of about 40 p.p.m. of Santobrite. (Standard types of wet or dry feed mechanisms can be used but Santobrite can be just as easily and efficiently introduced by hanging one-ounce briquettes in a wire basket in a circulating water passage where they will dissolve gradually.)

2. Maintain the concentration of 40 p.p.m. for about 10 to 15 days, which is usually long enough to completely kill and remove any existing slime and algae deposits.

3. Gradually *reduce* the chemical concentration for 15 to 20 days until the algae growth just reappears. Then *increase* the concentration by about 5 p. p. m. and maintain at this figure.

4. Maintain the minimum effective concentration thus determined by daily or semi-daily additions.

The daily make-up dosage is computed on the basis of the amount of fresh water added to the system. The initial charge, of course, is computed from the static capacity of the system.

Since the application of Santobrite requires no special equipment and only a nominal amount of labor and supervision, the principal cost of the treatment is the cost of the chemical itself. For a typical cooling tower system, serving a 55-ton Freon air-conditioning installation, the total cost for an average season from April to November was less than $5. On several large industrial systems, the cost has averaged about 40 cents per million gallons of water, circulated.

Santobrite can be efficiently used in all industrial cooling-water systems where the bulk of the cooling water is recirculated and reused, and where it is not used for drinking or bathing. Santobrite is not economically practical, however, for systems where the cooling water is not recirculated or where only a small part is recovered.

For full information on Santobrite, how, when, where and how much to use for best results, write today for Monsanto Technical Bulletin 0-15. MONSANTO CHEMICAL COMPANY, Organic Chemicals Division, St. Louis, Missouri.

MONSANTO CHEMICALS

"E" for Excellence . . . denoting the highest service accomplishment of the United States Navy...flies over Monsanto "in recognition of production of ordnance materiel vital to our national defense." In addition to the Ordnance flag and "E" pennant, above, Monsanto has now been awarded the All-Navy "E" burgee "for excellence in war production."

SANTOBRITE
for Slime and Algae Control

SERVING INDUSTRY . . . WHICH SERVES MANKIND

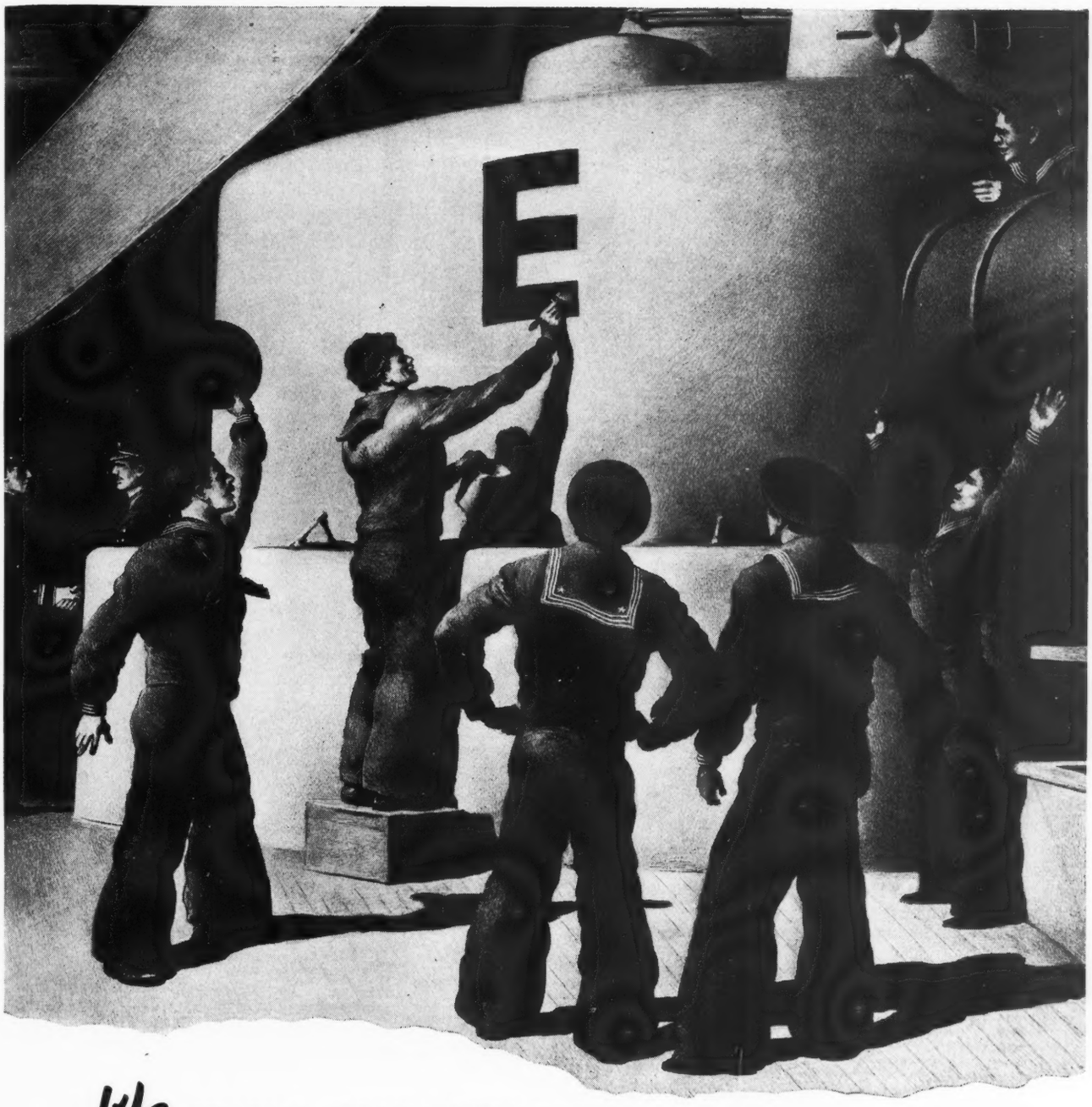
that electrical growth in the West was most rapid. In 1923 Mr Cranston went from Portland to San Francisco to become Pacific Coast manager, and in the same year he was elected a commercial vice-president of the General Electric Co.

ROBERT F VOGT, chief consulting engineer of the Allis-Chalmers Mfg Co since 1937, and an employee of the company for 36 years, died April 17. Mr Vogt's professional career began in the United States about 40 years ago when he came here from Switzerland, where he was born. He was a graduate of the Swiss Polytechnicum at Zurich. He joined the Allis-Chalmers organization in 1907 as a mechanical engineer. After years of experience in design and development work in various departments, Mr Vogt was appointed assistant chief consulting engineer in 1921. In 1937 he succeeded J F Max Patitz as the company's chief consulting engineer.

RICHARD L YATES, 59, vice-president and general manager of Skinner Engine Co, Erie, Pa., died of a heart attack at his home, Sunday, April 19. Born in Washington, Mich., on Dec. 2, 1892, Mr Yates received his early education at the local schools, and later was graduated from the Michigan State College with a degree in mechanical engineering. In 1918 he came to Erie as general manager of the Skinner Engine Co.

MORRIS S TOWSON, president and general manager of the Elwell-Parker Electric Co, of Cleveland, died in Orlando, Fla., on March 17. He was 76 years old. Born in Cleveland, Mr Towson was graduated from Case School of Applied Science in 1886, and for several years

was associated with the Brown Hoisting Machinery Co there. In 1893 a separate company was organized to build the Elwell-Parker motor under British license, and Mr Towson was placed in charge. Mr Towson was considered the pioneer and father of the power truck



We KNOW HOW THEY FELT!

Those men who earned the first Navy E, back in 1906, must have been the proudest crew of tars in the fleet. We know, for we feel the same bursting pride today. The blue Navy burgee now flying from our flagstaff sends a special thrill through every man in our plant. We're proud to be Americans.

The Navy E is not lightly given, nor lightly received. It means more than Excellence. It stands for a good job well done, for teamwork better than the best . . . and its award to any civilian plant should double and redouble fighting spirit. From now until final Victory dawns, we pledge every effort to help *Keep America Rolling.*

FOR VICTORY
BUY UNITED STATES SAVINGS BONDS AND STAMPS

Exide
BATTERIES
FOR CRANKING DIESEL ENGINES

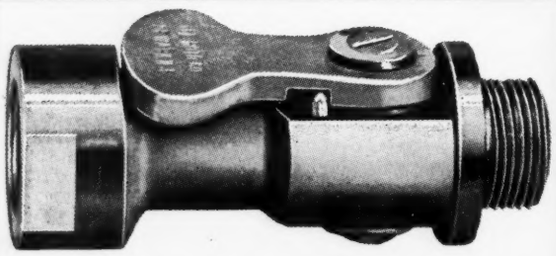
THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia
The World's Largest Manufacturers of Storage Batteries for Every Purpose
Exide Batteries of Canada, Limited, Toronto

These low-cost items save time, labor and money in tube cleaning

Anything that saves time, labor and materials is good news today. The accessories illustrated may be used with most makes of tube cleaners. Write for details.

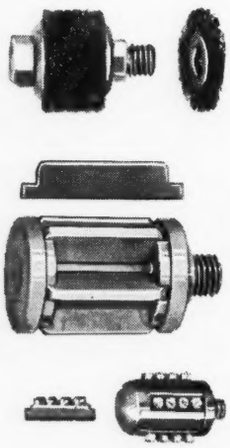
Combination drill heads offer savings

This head is an exclusive Roto economy feature. Consists of three separately replaceable parts, made of different materials to suit the type of wear to which each is subjected. Worn parts are renewed at great savings over the cost of ordinary one-piece drills.



ROTO Air Valve saves the cost of a helper

Enables one man to operate the tube cleaner by himself. Saves time too, because it eliminates the necessity of signalling a helper to turn the air on and off between every tube cleaned. Attachable to most makes of cleaners for straight or curved tubes.



Made extra rugged for severe cleaner service

Ordinary universal joints soon loosen up under the severe abuse to which tube cleaners subject them. Roto joints are especially built to withstand such service. Note the peculiar way rivet heads are secured.

Replaceable parts save money cleaning small tubes

Roto brushes with replaceable sections (top), expanding scraper heads with renewable blades (center), and expanding brushes with replaceable sections (bottom) provide great economies in cleaning small tubular equipment. Roto heads give long, satisfactory service.

See Our Adv. in SWEET'S — **The ROTO Company** — 145 Sussex Ave., Newark, N. J.

ALLPAX

THE PACKING THAT "PACKS ALL"

THE ALLPAX CO., INC.

Mamaroneck, N. Y.

•

Distributors Everywhere

. . . use it once and

. . . you'll use it always

Here's the universal packing that can be used for any fluid or on any apparatus. One size packs all—economically, efficiently—tightly—simply.

Try ALLPAX and you, too, will be enthusiastic over its easy application and long wear. You don't have to remove old packing to repack with ALLPAX. Square cross section makes ALLPAX easy-filling in any stuffing box.

Try it and you'll always use it. Full details on request.

industry, the commercial development of which began in 1906. He developed and patented many practical basic features which were incorporated in power industrial trucks.

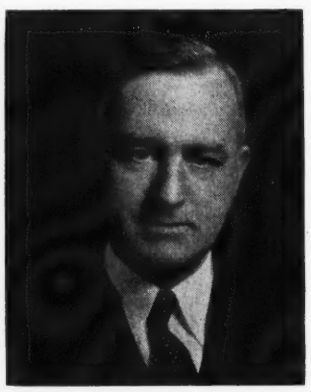
GEORGE A YERKES, a stationary engineer with the Rochester, N. Y. Board of Education for 30 years prior to his retirement in 1932, died April 28. He was 77 years old.

WILLIAM R WILCOX, a stationary engineer for the Rochester Gas & Electric Corp, died April 5 at his home in Rochester, N. Y. He had retired two years ago after serving nearly 35 years with the utility.

PERSONALS

FRANK M WARREN, JR, has been appointed second vice president of the Portland General Electric Co. Mr Warren was formerly assistant to the president. After being graduated from the Stamford School of Engineering and the Harvard School of Business Administration, Warren joined the Portland General Electric Co in 1937 as statistician, and later became assistant to the general division manager.

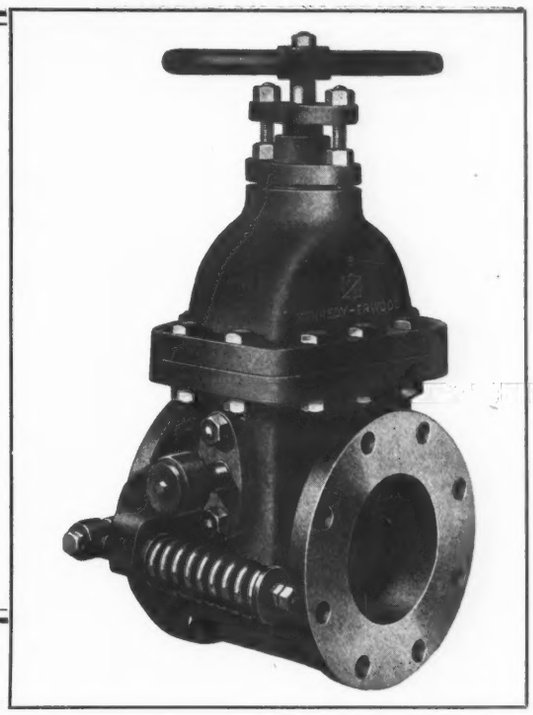
WALLACE K BROWN has been appointed vice president in charge of procurement for the Crocker Wheeler

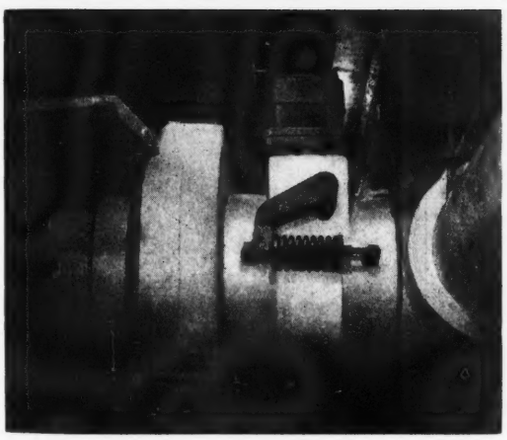


Electric Mfg Co. His new responsibilities include coordinating and expediting all related functions of the procurement and purchasing departments. Mr Brown started with the Crocker Wheeler organization as an apprentice engineer in 1908 after completing his techinical training at Clarkson College of Technology and the University of Illinois. Since then he has been district manager in San Francisco and Newark, and eastern sales manager in New York. He was elected vice president and appointed general sales manager in 1938.

P Y DANLEY has been appointed assistant sales manager of the merchandising division and H F HILDRETH has

Protect Low Pressure Apparatus from Excessive Pressures *with the* . . . . . KENNEDY-ERWOOD *Safety* Swing Gate Valve





Typical installation of the Kennedy-Erwood Swing Gate Valve on the exhaust line between turbine and condenser. An extended stem with floor stand in the turbine room permits convenient hand-operation, and the spring may be set for automatic relief at any predetermined pressure.

This unique design combines the functions of a gate valve, check valve, and relief valve in a single unit. It may be hand-operated as a standard gate valve, and when closed, its adjustable spring-controlled disc will automatically relieve excessive unbalanced pressure in any apparatus or pipe line.

For example, used as a non-return valve on the exhaust line between turbines or engines and condensers or heaters, the Kennedy-Erwood valve protects the low-pressure casing against building up of pressure which might cause failure and serious damage to equipment or injury to operatives.

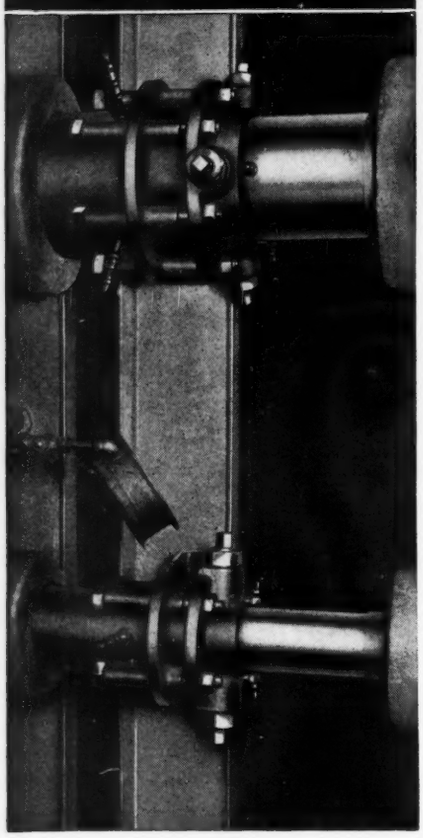
Other applications are as a back-pressure valve, atmospheric relief valve, or safety gate valve on pumps, compressors, etc.

Write for full information on this important aid to greater plant safety.

THE KENNEDY VALVE MFG. CO.
ELMIRA, N. Y.

KENNEDY-ERWOOD
Safety **SWING GATE VALVES**

YARWAY
GUN-PAKT
EXPANSION
JOINTS



Big Automobile Company Uses 67 Yarway Joints

First purchased 3 years ago. Reordered 7 times to present total of 67 Yarway Gun-Pakt Joints, ranging in size from 3 in. to 14 in.

Why don't you select the Expansion Joint that is packed under full steam pressure. A twist of a wrench forces a special semi-plastic packing into the stuffing box by means of integral pressure guns. No need to remove old packing. New packing rejuvenates the old. No need to shut off steam. Write for Catalog EJ-1907.

YARNALL-WARING CO.
100 Mermaid Ave., Phila., Pa.

been made manager of commercial refrigeration and air conditioning sales of Westinghouse Elect & Mfg Co. Mr Denley continues as head of war products of the merchandising division, a position he has held since Aug 1941. Mr Danley will also direct merchandise sales activities carried on from the Springfield works. Mr Hildreth has been sales development manager of the department he now heads since July 1941.

A JOHN BAUMGARTEN has been appointed manager of sales for the Central Pennsylvania district of the McClave Co. His headquarters will be at the company's home office, 751 Mill St, Allentown, Pa. Mr Baumgarten is a graduate engineer of Cornell University and has been associated with the Pennsylvania Power & Light Co for the past fourteen years.

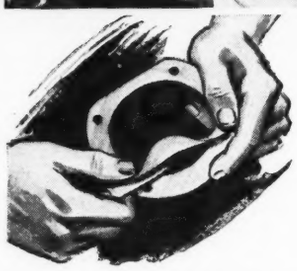
ROBERT GRANT has been appointed vice president in charge of manufacturing of the Young Radiator Co, Racine, Wis. He has been associated with the Young organization for the past year as executive in manufacturing. Mr Grant received his early production training as a line superintendent with the Nash motors division of the Nash-Kelvinator Corp. He later filled other important assignments in the production and management field before coming to the Young Radiator Co.

DEAN E MCCRORY, attached to the Pittsburgh office of the heavy chemical sales division of the Pennsylvania Sali Mfg Co since 1936, has been transferred to the company's executive offices in Philadelphia, Pa. He will be concerned with the sales of a number of important products of the company. Mr McCrory was graduated from Franklin and Marshall College and took graduate work in sanitary engineering at Carnegie Tech.

W C BUCHANAN, president of the Allis-Chalmers Mfg Co, has resigned because of ill health. Mr Buchanan had undergone a series of operations recently, with the result that on the advice of his physician he decided to reduce his activities for some time. The directors of the company elected Walter Geist, formerly vice-president, as executive vice-president, but there will be no election of Mr Buchanan's successor until after the annual meeting.

DR LEWIS B MILLER has joined the consulting staff of W H and L D Betz, Philadelphia, Pa. Dr Miller was graduated from the State University of Iowa

gain hours



Use Laminum shims to reduce parts machining for easier work tolerances in factory adjustment! More machine hours released for production.

Laminum shims (.003 or .002 inch precision laminations bonded into a solid unit) are cut to your specifications.

Stock shim materials obtainable from mill supply distributors. (Write us for sample and illustrated shim application chart.)

Laminated Shim Company
Incorporated
61 Union Street **Glenbrook, Conn.**

it's
LAMINUM
THE SOLID SHIM THAT peels FOR ADJUSTMENT

An open letter to 184,230* arsenals...

E. F. HOUGHTON & CO.

PHILADELPHIA, PA.

June, 1942

Gentlemen:

Remember three years ago when plants faced 36-hour work weeks, and "M-Day" stood for a silly idea that on some far away date our United States would have to be ready for Mobilization?

Then M-Day came out of the blue, and 40-hour work periods stretched to 168-hour weeks, as we drafted an answer to "theirs of December 7th."

Machines would win the war, they told us. Army, Navy and Air Corps stood with outstretched hands, pleading for faster and still faster output from Machines driven by eager men, directed by one-purpose minds. Barehanded bravery alone can't win, said Mr. Roosevelt and Mr. Nelson and General Knudsen.

M-DAY, now, is MACHINE DAY. And M-Day may last for years. Anything which halts machine production is subversive. But, pressed up to and often beyond the limit of its capacity, the Machine is wearing out more than three times as fast today as it did in

(over)

* FROM THE CENSUS OF MANUFACTURES

times of normal eight-hour shifts.

The one greatest way to make Machines last longer and produce more, with minimum down-time, is to lubricate them, wisely and adequately, with the best lubricants modern science can provide ...lubricants built to maintain a fortified film separating metal from metal.

Oil does not "wear out." If it's unstable, it may change chemically and lose its effectiveness. How rapidly it deteriorates, depends upon the basic quality, type of stock and treatment which its maker gives that lubricant. Oil as it comes from the refinery isn't ready for your high-speed, heavy duty machines until we "do things" to it.

And that's where the makers of modern lubricants - to name one leader: E. F. Houghton & Co. - play a most important part.

So much has been accomplished over these recent years, both in design of equipment and formulation of stable, Extreme-Pressure, leak-resistant oils, that delays due to Machine break-down are inexcusable if the reason is incorrect or insufficient lubrication.

In the interests of peak production, may we present a few ideas on how today's oils, developed by scientific treatments and additives, are lengthening Machine life in these hectic 168-hour weeks?

Continued on page 4

THESE THINGS WE DID...*for* BETTER LUBRICATION

As the Oil Chemist explains them:	**Houghton calls them:**	*They do this for you:*
1 POLYMERIZATION — Molecular change effected by treatment of fluid lubricants and mineral oils used in grease bases, imparting increased adhesion to metals and great leak resistance—without necessitating the addition of soaps, fats or vegetable oils.	**STA-PUT LUBRICANTS** *Less oil... Less often* **STA-PUT LUBRICANTS**	The oil stays where needed; no drip or splatter. Less frequent oiling, less oiling labor, less danger of machine failure through insufficient lubrication of overworked machines. Greater oiliness than straight mineral oils of similar viscosity.
2 HIGH FILM STRENGTH — Research has resulted in high grade lubricants so treated as to double or triple their load-carrying capacity.		This great strength of film resists shocks or sudden reversals of loads; prevents breakdowns caused by metal-to-metal contact (friction). Insures perfect run-in.

3 EXTREME PRESSURE GEAR OILS—

Subjecting a clear, highly refined mineral oil to a scientifically designed treatment—providing high film strength and unusual chemical stability.

"VITAL" E. P. GEAR OILS

Wide range of applications reduces stocks required. Provides positive lubrication at all operating temperatures, without corrosion or oxidation. A "fortified film" series in S. A. E. grades 20 to 500.

4 ALL-PURPOSE LUBRICANTS—

An unusual blend and treatment of high-grade oils combining high stability, high demulsibility and low carbon formation. One oil for both tough and ordinary jobs.

D. L. ABSORBED OILS

Simplifies purchases and inventories. One oil for Compressors of all stages, Turbines, Dynamos, Engines, Lineshafting and Machine Tools—circulating systems and bath-lubricated.

5 REVERSIBLE GREASES—

For ball and roller bearings—"pre-worked" sponge-base greases, chopped, calendered and smoothed. Short shear, less fibrous, not ropy. Can be heated and cooled repeatedly without separation or deposition of hard residue.

ABSORBED OILS 75-500 SERIES

Better retention—maintaining effective seal. More easily applied by grease guns. Stability and high quality provide unusual reversibility features.

6 HYDRAULIC OILS—

Finest petroleum oils scientifically fortified with synthetic organic compounds providing (1) Tripled film strength, (2) Oxidation stability, reducing gum and sludge, (3) Highly effective solvent action, (4) High viscosity index.

HYDRO-DRIVE "MIH" SERIES

(1) Reduce wear through "fortified film."
(2) Lessen harmful deposits.
(3) Solvent properties supplement stability obtained through anti-oxidant, holding potential gum formations in solution.
(4) Better viscous seal—minimum viscosity change at all operating temperatures of hydraulically controlled units.

7 GREASES AND OPEN GEAR LUBES WITH NO ASPHALT CONTENT—

Adhesive lubricants have been perfected, combining Sta-Put-treated mineral oils with lime, aluminum or soda bases.

STA-PUT 400-500 SERIES

More adhesion with less friction. No blowing of fuses when starting in cold weather. Not a "paint", not sticky; no heating necessary to apply.

8 HIGH-FILM-STRENGTH SPINDLE OILS—

Developed light grades having greater oiliness and twice the film strength of untreated oils. Definite improvement for super-finish spindles having clearances under .0003", as well as heavy duty spindle applications.

KENSINGTON SPINDLE OILS

Eliminate need for dilution with kerosene for the most closely fitting spindles. No danger of sticking from gum formations. Less wear, because of E. P. treatment. Less inventory required in the plant.

9 DIESEL ENGINE OILS—

Answered challenge of modern Diesel design through development of full line made from selected base stocks, fortified for oxidation stability, gum solvent properties, high film strength, detergency.

MOTOLINE DIESEL OILS

Improved engine efficiency by maintaining "oil-as-blended" characteristics . . . extending ring and liner life . . . reducing varnish, lacquer and crankcase sludges . . . eliminating excessive port and valve deposits . . . extending bearing life.

10 CYLINDER OILS—

Development some years ago of first cylinder lubricant not compounded from animal fats and mineral oils. Permits use of higher viscosity oils because of special process of manufacture.

CYLTAL

Cylinder oil consumption cut in half! Fast wetting-out means splitting up and oiling of cylinder walls between engine cycles. Less oil, better lubrication.

11 SPECIAL OILS FOR SPECIAL PURPOSES—

Houghton research history abounds with examples of specialty lubrication developments now on volume basis, such as the examples listed in the adjoining column.

Worm Gear Oils
Oven Conveyor Oils
Glass Mould Aids
Twister Ring Greases
Needle Rust Preventives

The advantages to the user of these special-purpose lubricants are too extensive to list here in detail. The Houghton Lubrication Technical Staff will welcome individual problems submitted for solution.

Therefore, for WPB whose duty it is to speed production...for management men whose sleepless nights and harassed days are making them old before their time...and for the countless thousands of workers in the nation's "arsenals" who must push tired machines beyond their limits - for all these we have put into the record here a part of the story of what has happened to lubricants. It's too long to tell all, but these items are important examples.

Many of them are exclusive Houghton accomplishments. All of them have made possible a mass production the Jaxis in its wildest dreams never imagined. And even more can be done when more men realize that "oil is not just oil."

We are emphasizing in our product messages to plant men that "In Times Like These, the Best Oil You Can Buy is the Only Good One." If that thought can be driven home to every user and owner of these Machines on which our armed forces depend, we will feel that a worthwhile bit has been contributed towards the war effort, making M-Day...V-Day.

Yours for Victory,

E. F. HOUGHTON & CO.

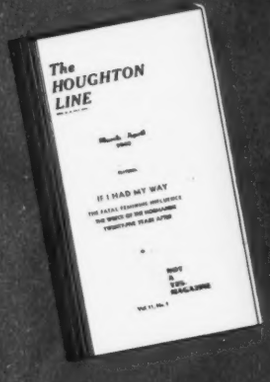
Aaron E. Carpenter

A. E. Carpenter
President

It was just after the close of the Civil War and Drake's discovery of oil in Western Pennsylvania that Edwin F. Houghton set up a laboratory in Philadelphia almost in the shadow of Independence Hall. He began to explore the commercial possibilities of petroleum, then almost unknown. In this pioneering research leading chemists of that day were enlisted.

From that humble beginning, E. F. Houghton & Co. has grown through 77 years, until today it operates five plants in the United States and Canada, supplies the world with specialized lubricants, leather belting and packings, textile oils, metal working and heat treating products. There's a Houghton Man as near as your telephone, ready to help you extend machine life.

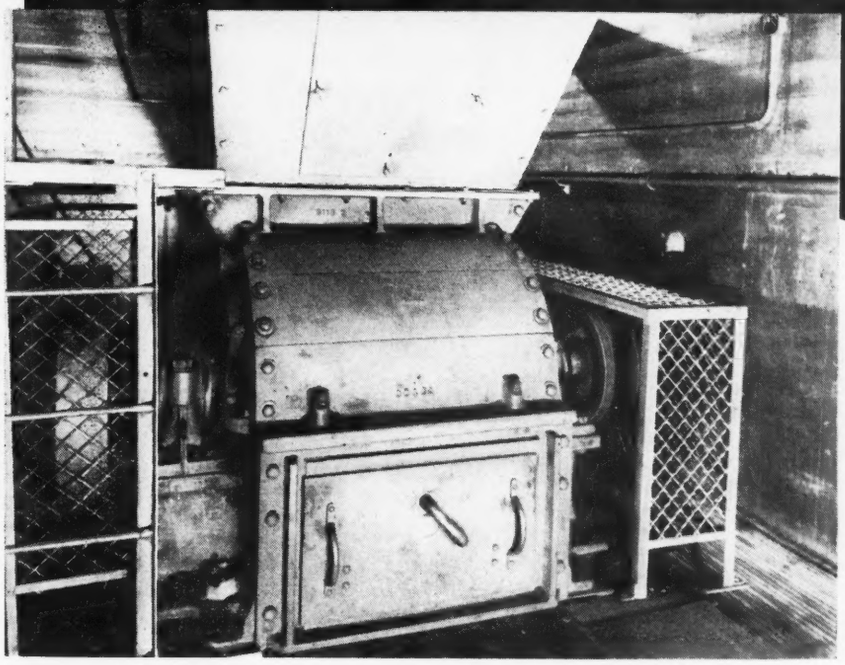
You should be on our free list for America's best known industrial house magazine. Write us . . .



E. F. HOUGHTON & CO.

CHICAGO ★ PHILADELPHIA ★ DETROIT

PREPARING COAL THE ECONOMICAL "AMERICAN WAY"



"American" Ring Crusher at the Walnut Plant (near Groveport, Ohio) of the Columbus & Southern Ohio Electric Company, Columbus, Ohio.

. . . at the Columbus & Southern Ohio Electric Company

Proper coal preparation is a "must" today in order to insure maximum plant capacity for stepped up production requirements. By taking advantage of the tried and proved "AMERICAN" way to size coal, the Columbus & Southern Ohio Electric Company has provided the means of improving combustion and at the same time is prepared to meet the demand for more steam. This "American" Ring Crusher was installed about a year ago and is living up to the "AMERICAN" reputation for exceedingly low crushing costs—less than one cent per ton for power, labor, maintenance, interest and depreciation.

"AMERICAN" Ring crushers are of heavy steel construction for long life, are equipped with anti-friction bearings for low power consumption and can be depended on for high crushing capacity.

●●●

If you are concerned with getting the most from your coal—whether for stoker or pulverized fuel firing—investigate the "AMERICAN" WAY. Send for a copy of "CRUSHING COAL AT LESS THAN ONE CENT PER TON," which contains important data on how to size coal properly for maximum performance.

THE "AMERICAN" SPLITS COAL INSTEAD OF CRUSHING IT

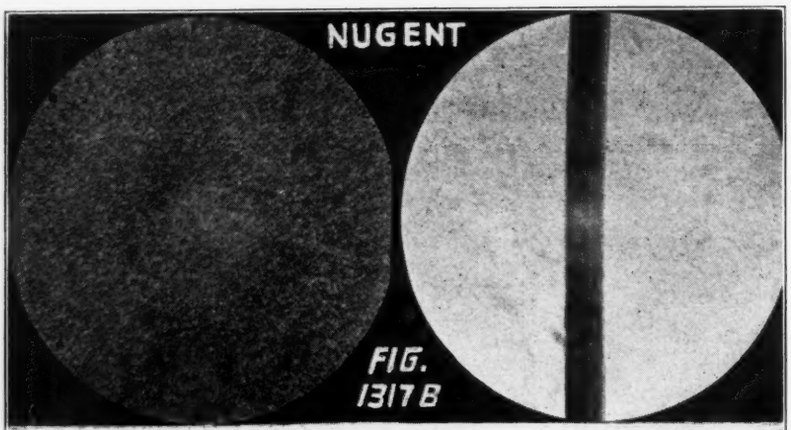
Patented manganese shredder rings with 20 cutting edges or teeth, strike, roll and split the coal before it reaches the breaker plates. A minimum of fines results. Proper sizing is easily controlled for specific operating conditions.

AMERICAN PULVERIZER COMPANY

ORIGINATORS AND MANUFACTURERS OF RING CRUSHERS AND PULVERIZERS

1349 MACKLIND AVE., ST. LOUIS, MISSOURI

Here's a Proved Method for Conserving Lubricating Oil..



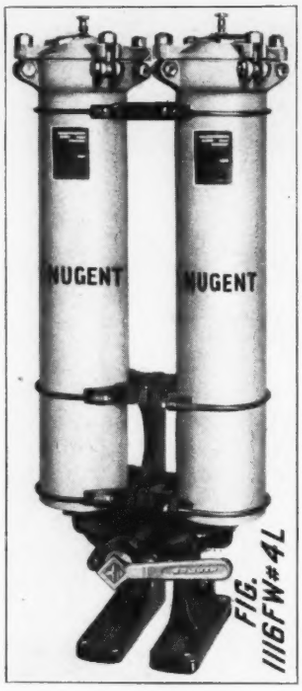
—*Install* NUGENT FILTERS!

FOR obvious reasons, it is now more important than ever to conserve all grades of lubricating oil, as well as all other types of cutting oils, coolant, etc. One sure way to emphasize the conservation of oil is available through the installation of Nugent Filters in oil lines, to provide a positive method for removing dirt particles, and allowing complete recirculation of **clean** oil every cycle.

The photomicrograph reproduced above demonstrates the ability of Nugent Filters to remove harmful grit, dust, sand, carbon, abrasives, etc., from lubricating oils. This photo shows lube oil sample **before** and **after** installing a Nugent Absorbent (Waste) Type Oil Filter on a 600 H.P. Diesel. The "after" sample was taken at 1800 hours operation. Waste is renewed every 700 hours. The line through the "after" picture is a human hair. The large dirt particles in the "before" sample are about .0003".

Another big reason for the widespread use of Nugent Oil Filters is their ease of application. No complicated pipe connections—no redesigning of the lubricating system—a minimum of auxiliary fittings. And remember—**the oil is all that moves in a Nugent Filter, and it does not wear out!**

Write for full details.



NUGENT Patented Pressure Filters have 20 TIMES MORE ACTUAL FILTERING AREA than most filters of comparable size. Nugent's special woven, acid resisting, lintless textile filter element removes particles as small as .0003" to produce 99-8/10% clean oil. In asking for quotations, please mention gals. per min. circulated and viscosity of oil at operating temperature.

Wm. W. Nugent & Co., Inc. Mfrs.
Oil Filters, Oiling and Filtering Systems, Telescopic Oilers, Oiling Devices
Sight Feed Valves, Flow Indicators, Compression Union Fittings, Oil Pumps, Etc.
402 N. HERMITAGE AVE. Established 1897 CHICAGO, U.S.A.

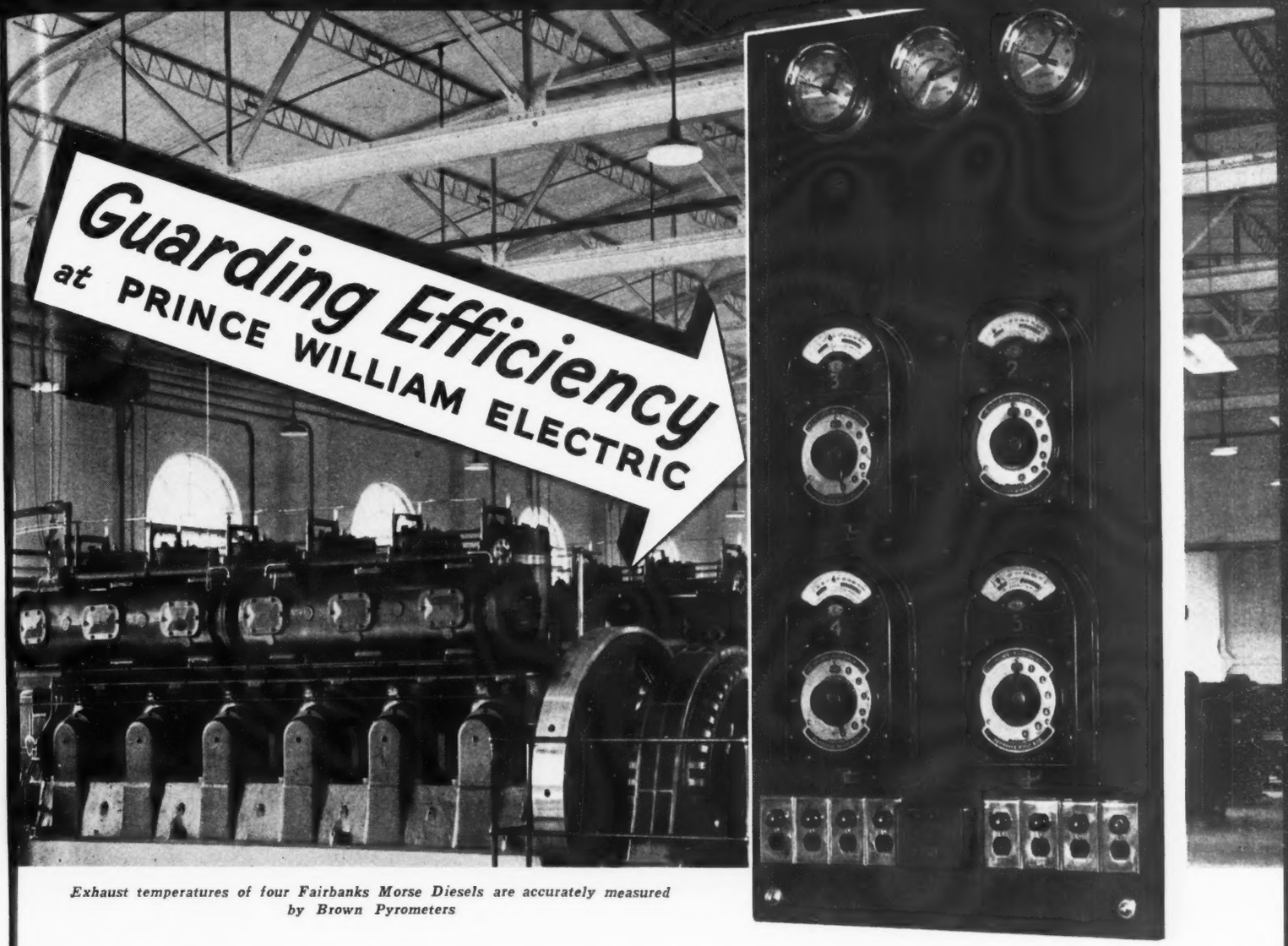
with a Bachelor's and Master's degree and received his Doctorate from Columbia University. He has been engaged in research on problems relating to water purification and sewage disposal and is the author of 35 papers, most of which deal with industrial process water problems.

S J HORRELL has been appointed vice-president of the executive board of Associated Piping & Engineering Co, Ltd. industrial piping fabricators with main offices in Los Angeles, Calif. Mr

Horrell was formerly associated with the Blaw-Knox Co, Pittsburgh, as a vice president of their power piping division in charge of sales and engineering. He was also active for many years with the Grinnell Co, Providence, R. I.

CHARLES H CURRIER becomes the new president of the Tubular Exchanger Manufacturers' Association as a result of the election held in New York City recently. Mr Currier is vice president and general manager of Ross Heater & Mfg Co, a division of American Radiator and Standard Sanitary Corp, with general offices and plant in Buffalo, N. Y. Headquarters of the association at 366 Madison Ave, New York, N. Y.

G LEE CAMP retires as vice president, member of the board of directors and co-general manager of the organic chemicals division, Monsanto Chemical Co, St. Louis, Mo. Mr Camp was born in Midland, Mich., June 11, 1882. He went to work for the Dow Chemical Co in 1901, rising from a laborer until in 1929, when he resigned, he had attained the position of general sales manager in charge of sales and distribution. He remained inactive for a year before joining Monsanto as assistant to the president. He served in this capacity a short time and was elected a vice president for the company, devoting most of his effort to the sales activities of the company. In 1930 he was elected a member of the board of directors, and on May 1, 1939, became, in addition to his other responsibilities, the co-general



Exhaust temperatures of four Fairbanks Morse Diesels are accurately measured by Brown Pyrometers

WHEN the Prince William Electric Cooperative put into service its new $200,000 Diesel generating plant, one of the major Rural Electrification Projects of the East was brought a long step toward completion.

In selecting and arranging equipment, nothing was spared to make this plant a model of efficiency and ease of operation.

Each of the four Fairbanks Morse Diesels are equipped with Brown Diesel Pyrometers for checking exhaust temperatures.

A simple turn of the switch—a glance at the clear open dial—and instantly operators have an accurate check on the measurement of the load and relative efficiency of each cylinder. Clearly marked, colored zones on the dial indicate whether temperature is high, normal or low.

Compact and light in weight, the Brown Diesel Engine Pyrometer is built for rugged service—unaffected by vibration or adverse atmospheric conditions. The switch contacts are extra large to withstand hard usage.

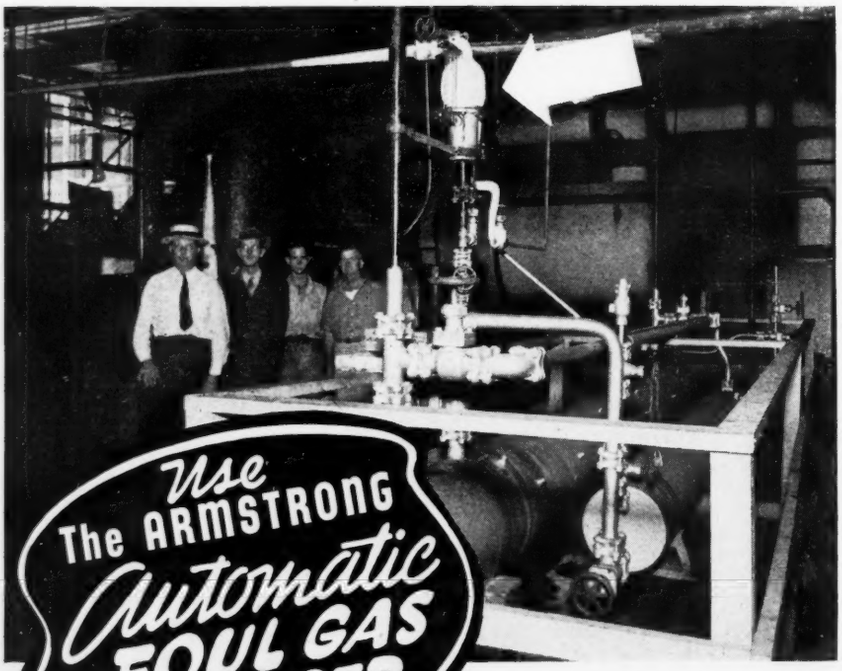
Wherever Diesel Engines are used—in industry—in transportation—on the sea—in the air, Brown Pyrometers have earned the preference of exacting engineers and the leading builders of Diesel Engines, because of their accuracy, simplicity, ruggedness and dependability. The saving in fuel alone has repaid the investment for Brown Pyrometers in many cases.

BROWN DIESEL ENGINE PYROMETER

THE BROWN INSTRUMENT COMPANY, 4490 Wayne Avenue, Philadelphia, Pennsylvania
DIVISION OF MINNEAPOLIS-HONEYWELL REGULATOR CO.
MINNEAPOLIS, MINNESOTA AND 119 PETER STREET, TORONTO, CANADA
Wadsworth Road, Perivale, Middlesex, England. Nybrokajen, 7, Stockholm, Sweden

CONSERVE

POWER • REFRIGERANT GAS



SAVE TIME! . . . INCREASE REFRIGERATION SYSTEM CAPACITY!

IF you are responsible for the operation of a compression type refrigeration system, we believe it will be well worth your while to know about the advantages offered by the new Armstrong Foul Gas Purger:

1. CUTS POWER COSTS — Records show reductions in head pressure of as much as 45 lbs. and power savings as high as 22% where purgers have been installed to remove foul gases.

2. MINIMUM LOSS OF REFRIGERANT GAS—Condensation within Purger takes place at high side pressure, but at low side temperature. Regularly eliminates 99% of the waste that often occurs when hand purging is used.

3. AUTOMATIC — After starting the Armstrong Purger requires no attention until after the system is rid of air.

4. INCREASES COMPRESSOR CAPACITY—Every 4 lbs. reduction in head pressure increases compressor capacity approximately 1%!

5. LARGE CAPACITY—The No. 243 Purger shown here has been used successfully on systems ranging in size from 12 tons up to 1200 tons capacity.

6. FOR ANY REFRIGERANT. Standard Armstrong Purgers are working successfully on Freon, ammonia and butane. Special high pressure units are available for CO_2.

We will be glad to send you complete information. Write ARMSTRONG MACHINE WORKS, 812 Maple St., Three Rivers, Mich.

Backed by a Nation-wide Sales and Service Organization

ARMSTRONG has 50 Factory Representatives located in principal centers in United States, Canada, and Spanish speaking countries. In addition, some one hundred sub-agents represent Armstrong in other centers.

manager of the organic chemicals division.

A D Rose, for many years sales manager, has become assistant general manager of the James P Marsh Corp. The position he has vacated will be filled by James Emmett. Jr. formerly assistant sales manager.

J R Michel, efficiency engineer for Commonwealth Edison Co, Chicago. Ill., has been elected chairman of the Chicago section of the American Society of Mechanical Engineers. He was vice chairman of the group during the past year. A graduate in mechanical engineering from Purdue University, Mr Michel has been with Commonwealth Edison since 1923. He served as assistant boiler room engineer, boiler room engineer and assistant chief engineer before being promoted to his present position.

Edwin J Schwanhausser, of Buffalo, N. Y., has been elected to the board of directors of the Worthington Pump & Machinery Corp, filling a vacancy created by the death of Edward T Fishwick. Mr Schwanhausser has been a vice president of the corporation since 1939, and a member of the Worthington organization since his graduation from Stevens Institute of Technology in 1915. For fourteen years he was connected with the Harrison, New Jersey works, being appointed assistant manager in 1927. In 1929 he was appointed manager of the corporation's Buffalo works, and was advanced to the position of vice-president in 1939, assuming in addition to general administrative duties, responsibility for directing the corporation's sales of diesel and gas engines.

Dr. R. E. Hellmund Dies

Dr R E Hellmund, 63, chief engineer of the Westinghouse Electric & Mfg Co. and one of the most outstanding American electrical engineers, died May 16, in New York.

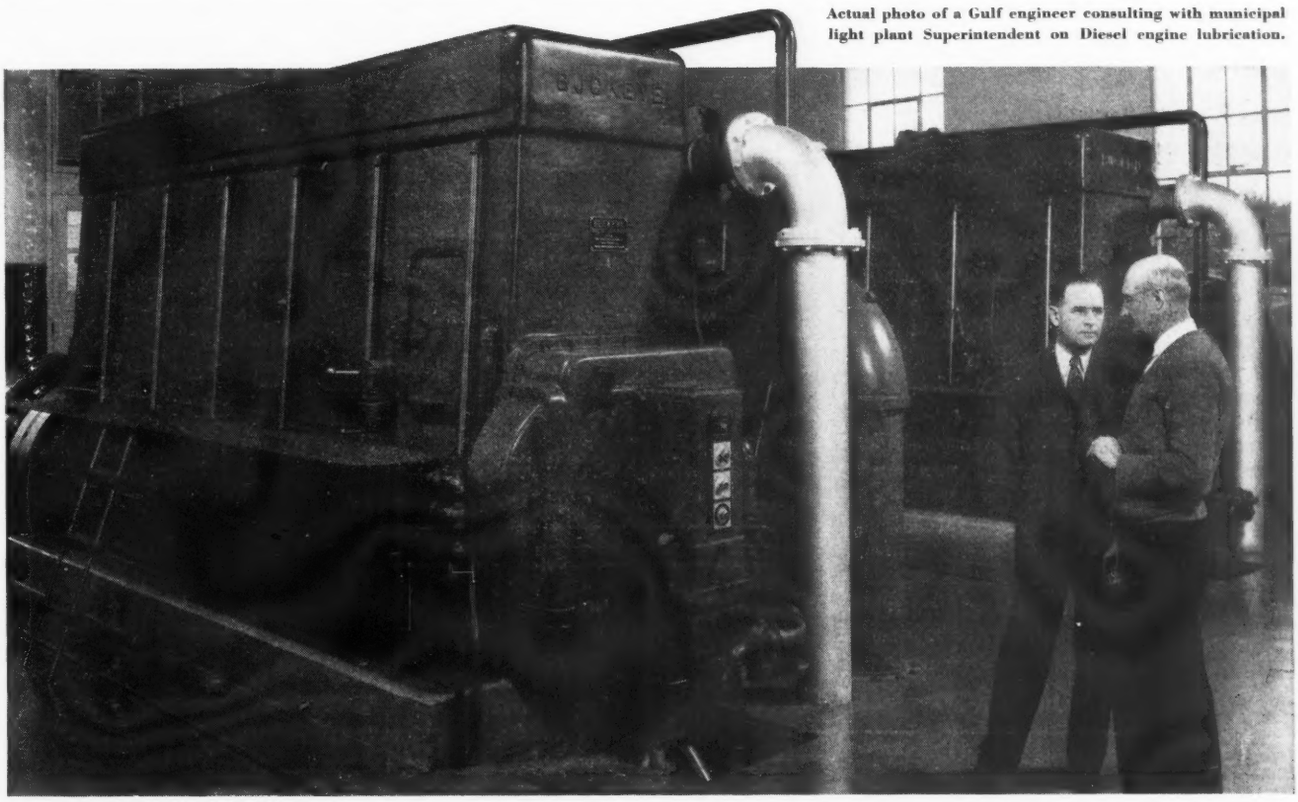
Born in Gotha, Germany, he studied engineering at the Technology College in Illmenau and at the University of Charlottenburg, where he was graduated in 1903. He came to this country in 1903 and joined Westinghouse four years later. Dr Hellmund was made chief engineer in 1933. He held more than 250 United States and foreign patents on electrical devices he had invented. He was the recipient in 1929 of the Benjamin Lamme Medal award by the American Institute of Electrical Engineers.

"Gulf Parvis Oil STANDS UP LONGER . . .

HELPS KEEP OUR OPERATING COSTS DOWN"

says municipal light plant Superintendent

Actual photo of a Gulf engineer consulting with municipal light plant Superintendent on Diesel engine lubrication.



"This quality oil performs better than any other Diesel lubricant we've ever used"

"WHEN we adopted Gulf Engineering recommendations and put Gulf Parvis Oil in service to lubricate our Diesels, we took a big step toward maximum operating economy," says this municipal light plant Superintendent. "Not only do we have very low maintenance expense with this quality Diesel lubricant, but our record of horse-power hours of service per gallon used is remarkable."

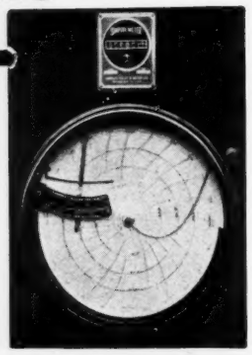
There are good reasons for the outstanding performance of Gulf Parvis Oil in the lubrication of large stationary and marine Diesel engines: Gulf Parvis Oil is especially manufactured from selected crude oils by the most modern refining methods. And built into this oil is *stability* and *stamina*—it stands up and provides full protection under the severe conditions encountered in Diesel engine service. Among its many advantages, Gulf Parvis Oil has a low carbon content—a safeguard against harmful carbon deposits from the lubricating oil.

This higher quality Diesel lubricant—and the more than 400 other quality oils and greases in the Gulf line—are quickly available to you through 1200 warehouses located in 30 states from Maine to New Mexico. Write or 'phone your nearest Gulf office today.

GULF INDUSTRIAL LUBRICATION

GULF OIL CORPORATION
GULF REFINING COMPANY
Gulf Building, Pittsburgh, Pa.

STEAM* FLOW RATE
IS EASY TO RECORD WITH
SIMPLEX
TYPE MS METERS



THE FLOAT MAKES THE DIFFERENCE!

The famous Ledoux bell-shaped float used in Simplex MS meters, automatically extracts the square root of the law of flow. As a result the float moves in direct proportion to the rate of flow.

WHAT DOES THIS MEAN TO YOU?

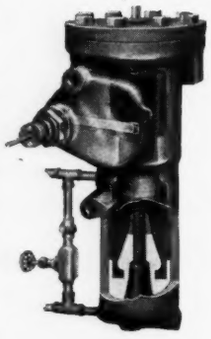
1—Evenly spaced charts—easy reading at both low and high rates.

2—A continuous type integrator—eliminating intermittent integrator movement.

3—Accuracy—the float directly connects to the pen arm which assures consistently high accuracy at low, intermediate, and high rates of flow.

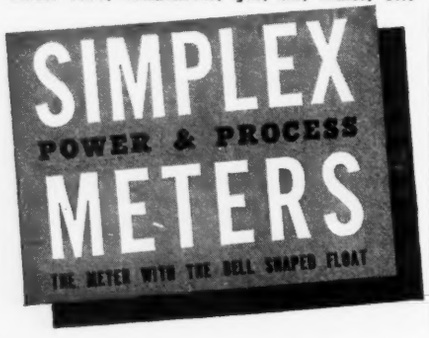
4—Elimination of friction producing cams and levers (it floats in water on mercury).

5—The precision machined hard rubber float is not affected by changes in temperature, nor by the type of liquid.



Movement of this specially designed float is caused by differential pressure from high and low pressure taps at Orifice plate, flow nozzle or Venturi tube. Write today for further information.

SIMPLEX VALVE & METER CO.
6780 UPLAND ST. PHILA., PA.
*Boiler feed, condensate, gas, air, water, etc.



BUSINESS ITEMS

ROBINS CONVEYING BELT CO, Passaic, N. J., announced that Alfred S. Otton is relieved of his former duties as advertising manager in order to handle important productive assignments in connection with the war work now being done by the company. John M Lupton, formerly assistant advertising manager, has been promoted to the position of advertising manager. He will be responsible for all the various functions of that department.

COPPERWELD STEEL CO, Warren, Ohio, announces the appointment of Howard W Broecker as assistant district manager in the Chicago district. Mr Broecker was previously connected

with the Youngstown Sheet & Tube Co in the Chicago district and with the Interstate Iron & Steel Co in the same district. N H Brodell has been appointed metallurgical sales engineer of the company. Mr Brodell is a graduate

of Carnegie Institute of Technology and was previously connected with Timken Steel & Tube Division, Pittsburgh Crucible Steel Corp, and the United Alloy Corp.

THE METALLIZING COMPANY OF AMERICA announce the removal of their Chicago general offices and Midwestern warehouse to new and larger quarters at 1330 West Congress St.

With heavy fuel oils badly needed to produce important materials for our armed forces, Deputy Petroleum Co-ordinator, Ralph K. Davis is reported as saying *"Consumers should convert to coal or other fuels as quickly as possible."*

When converting to coal, think of Gifford - Wood — designers, builders and contractors for modern coal and ash handling systems engineered to fit the job.

Idea book 200-P is full of ideas that may be useful to you. Write for a copy.

GIFFORD-WOOD CO.
Founded 1814
HUDSON, N. Y.
NEW YORK 420 Lexington Ave.
CHICAGO 565 W. Washington St.

2568

Ehret's D.I.P. gives MAINTENANCE-FREE service on Underground Pipe Lines . . .

TENS of thousands of feet of Durant Insulated Pipe with a record of years of service have proved the ability of this system to stand up under the severest conditions.

The reason lies in its construction. In Ehret's D.I.P. there is combined the time-defying characteristics of asphalt and the high insulating efficiency of 85% Magnesia. Factory pre-fabrication makes field installation rapid and economical. The result is an underground piping system that is outstanding, both in efficiency and long life.

(Send for the Ehret D.I.P. Booklet. It contains complete information on the D.I.P. system.)

EHRET MAGNESIA MANUFACTURING COMPANY

VALLEY FORGE • PENNSYLVANIA

DISTRIBUTORS IN ALL PRINCIPAL CITIES

No one would enter a battle with guns that wouldn't fire, or with machines that wouldn't run.

In the Battle of Production your equipment must also perform without failure. Hundreds of businesses and industries depend on refrigerating equipment as a vital part of their work. Warm weather, with its heavy loads—and overloads—will soon be here. Time now to have a check-up made of your cooling system.

A survey by a Frick Refrigerating Engineer will tell you not only what parts are dangerously worn, but whether you can save power, water, and labor, by the use of up-to-the minute equipment such as evaporative condensers and automatic controls. A few changes might materially increase the cooling capacity of your present system. And replacement parts are still available.

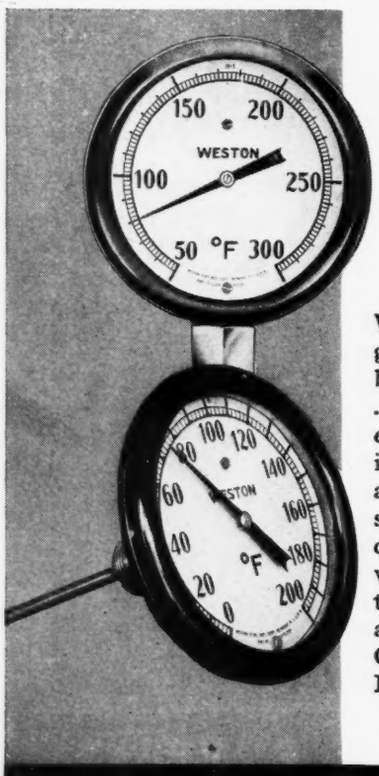
Be ready to fight hot weather! Get in touch with your nearest Frick Branch or Distributor now.

Get the advice of the nearest Frick Refrigerating Engineer on how to solve your cooling problems.

DEPENDABLE REFRIGERATION SINCE 1882

FRICK CO.

WAYNESBORO, PENNA., U.S.A.



thermometers, too,

MUST STAY ON THE JOB *LONGER!*

rugged all-metal thermometers resist breakage and maintain initial accuracies far longer!

With no gases or liquids to leak . . . no gears or other fragile parts to wear or break . . . no capillary requiring corrections . . . the WESTON all-metal Thermometer *exactly* fits today's needs for temperature indication that is thoroughly dependable and virtually trouble-free. Made in types, sizes, ranges and stem lengths for most industrial applications. Accuracy guaranteed within 1% over the entire scale. Literature containing complete information is available. Weston Electrical Instrument Corporation, 679 Frelinghuysen Avenue, Newark, New Jersey.

WESTON *ALL-METAL* **TEMPERATURE GAUGES**

J H Matthews and O H Cilley were elected to the board of directors of RAYBESTOS-MANHATTAN, INC, at a recent meeting of stockholders in New York. Dr Matthews is assistant general manager of the Manhattan Rubber Mfg Division, Passaic, N. J., and Dr Cilley is assistant general manager of the United States Asbestos Division, Manheim, Pa.

Promotion of Donald C Luce to general manager and Watson F Tait to assistant general manager of the PUBLIC SERVICE ELECTRIC & GAS Co was announced recently. Mr Luce succeeds Marion Penn., who died March 29. Also announced was the promotion of William R La Motte to general superintendent of electric generation, succeeding Mr Luce and Arthur R Nelson to assistant general superintendent of electric distribution, succeeding Mr Tait.

AMERICAN K A T CORP has moved its offices to 331 Madison Ave, New York, N. Y., effective May 1, 1942.

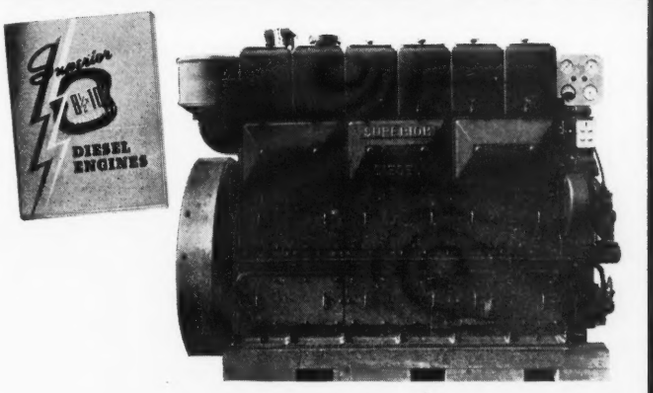
E W Jackson and D O Nash have been appointed assistant to the president and general service manager, respectively, of the CATERPILLAR TRACTOR Co, Peoria, Ill. Mr Jackson has been general service manager of Caterpillar since Jan. 1937. Mr Nash was born in San Joaquin Valley, Calif., and is an alumnus of Oregon State University. After seven years in the service department of the Cousins Tractor Co, Caterpillar distributor in California, he joined Caterpillar Tractor Co at San Leandro in 1937. Mr Nash has also served as manager of the service development division and manager of the service engineering division.

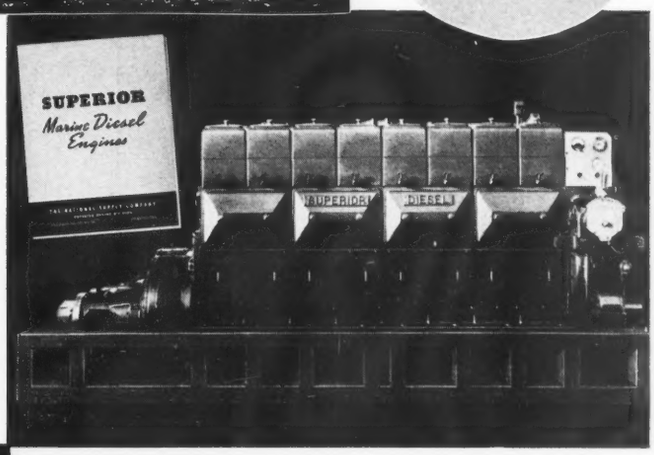
THE OIL-RITE CORP, Milwaukee, Wis., has moved its plant and offices to 3466 South 13th St., Milwaukee, Wis., as of April 15.

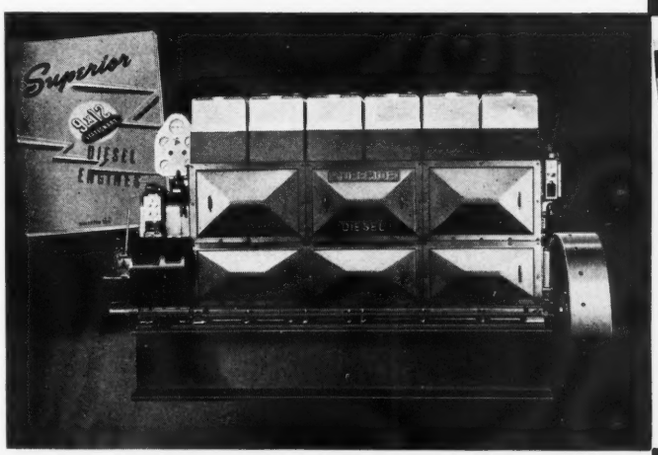
At a meeting of the board of directors of the CARBORUNDUM Co held at Niagara Falls, N. Y., Dr Frank J Tone retired as president of the company, and was elected chairman of the board of directors. The new president is Arthur A Batts, secretary of the company since March, 1927. Charles Knupfer, formerly vice president in charge of sales and a member of the board of directors, was named as senior vice president and will continue as head of the sales department. Henry P Hirchner has been named executive vice president in charge of operations. F J Tone, Jr. sales executive, was elected to the board and has been named vice president.

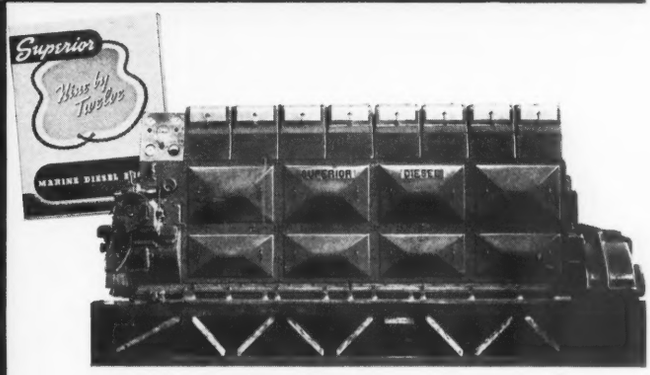
Now IS THE TIME TO GET ACQUAINTED WITH *Superior* DIESELS

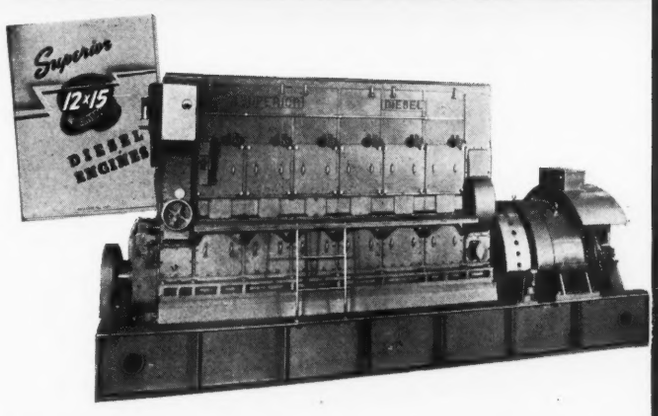
Write Today ON YOUR BUSINESS LETTERHEAD FOR THESE *New Bulletins*

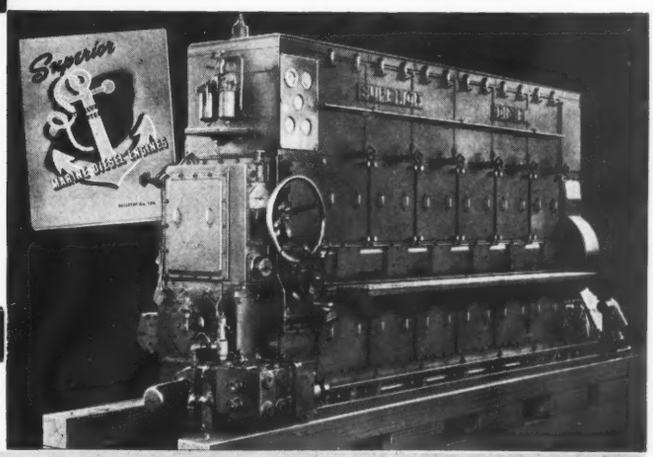






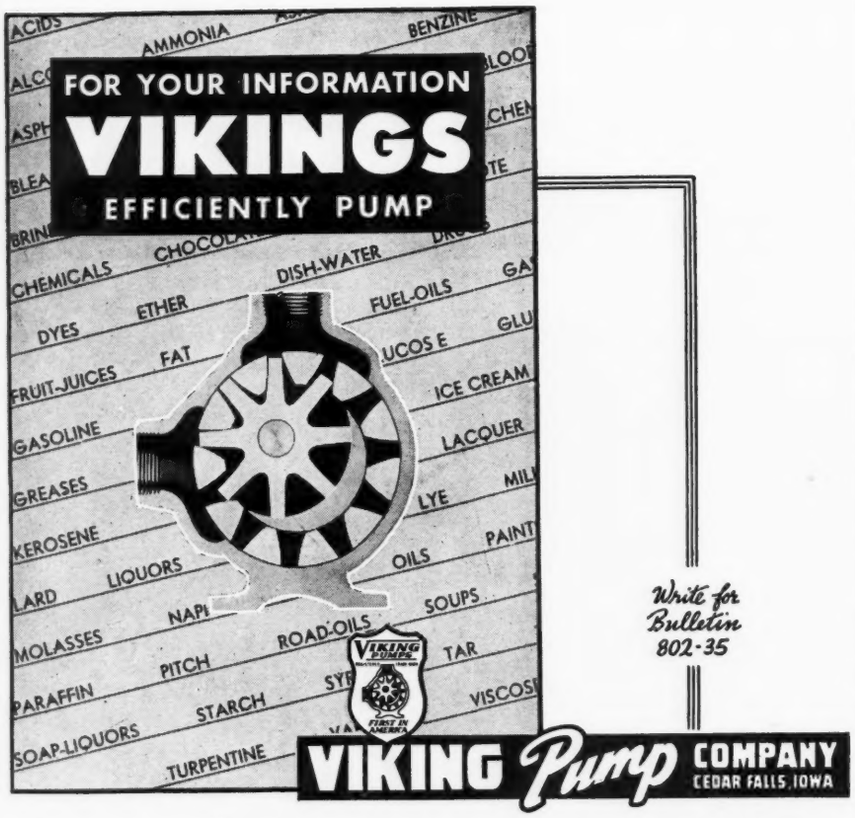






THE NATIONAL SUPPLY COMPANY... SUPERIOR ENGINE DIVISION

SALES OFFICES: Springfield, Ohio; Philadelphia, Penna.; New York, N. Y.; Los Angeles, Cal.; Jacksonville, Fla.; Houston, Texas; St. Louis, Mo.; Fort Worth, Texas; Tulsa, Okla.; Boston, Mass. FACTORY: Springfield, Ohio;

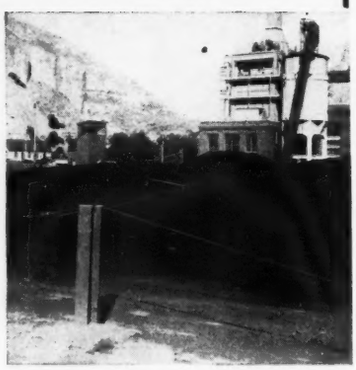


Store and Reclaim Coal for few cents per ton.....

SAUERMAN Scrapers are on record as handling coal for under 2c per ton at large power plants and for only slightly more at small plants.

This operating economy is just one of many reasons why SAUERMAN Scrapers have become the most widely used equipment for open storage of coal. Other advantages are:

- Machine is simple and easy to operate. From a station overlooking the storage area the operator controls every move of the scraper through a set of automatic controls.
- Machine is adaptable to any ground space regardless of the shape or condition of the area.
- Scraper piles coal in compact layers. There is no segregation of lumps and fines; no air pockets to promote spontaneous combustion.
- Each SAUERMAN installation is a permanent, trouble-free investment. Upkeep is easy.



Picture shows coal storage yard at a 25,000 KW. central station where a 1 cu. yd. Sauerman Scraper stores and reclaims about 130,000 tons of coal per year. These scrapers are made in sizes to carry from ¼-ton to 10-ton loads of coal.

If you have any coal storage problem write for the SAUERMAN Catalog.

SAUERMAN BROS., Inc.
562 S. Clinton Street, Chicago

SAUERMAN

POWER SCRAPERS FOR COAL STORAGE

Edward R Newcomb, sales executive, was also elected as one of the vice presidents of the company. Announcement is made of the retirement as treasurer of Frank H Manley, Sr, whose identity with the company dates back to 1896. He is succeeded by T B Foot who recently was named treasurer. Frank A Vockrodt, formerly auditor, was appointed secretary, A J D'Arcangelo and Gilbert J Stewart were named as assistant treasurers.

W A Shoudy has withdrawn from ORROK, MYERS & SHOUDY ASSOCIATES, to devote his entire time and services as engineer in charge of utilities division for the Chemical Construction Corp, 30 Rockefeller Plaza, New York, N. Y. George A Orrok and David Moffat Myers will continue their consulting practice as Orrok and Myers Associates, at the same office, 21 East 40th St, New York, N. Y. Large projects involving complete engineering and architectural features are handled by Binger-O'Connor-Orrok, 101 Park Ave, New York, N. Y.

The fifteenth semi-annual meeting of the EASTERN PHOTOELASTICITY CONFERENCE will be held on Saturday, June 20, 1942, at the University Club, 40 Trinity Place, Boston, Mass. W M Murray, Room 1–321, Massachusetts Institute of Technology, Cambridge, Mass., is chairman of the executive committee.

The twenty-seventh fall meeting of the TECHNICAL ASSOCIATION OF THE PULP & PAPER INDUSTRY (TAPPI) will be held in Boston, Mass., from Sept. 30 to Oct. 1, 1942, inclusive. Convention headquarters will be established at the Hotel Statler in Boston. National headquarters of the association is at 122 East 42nd St, New York, N. Y.

THE FEDERAL POWER COMMISSION announced its acceptance of the resignation of Thomas R Tate as director of its National Defense Power Staff and chief of its Bureau of Electrical Engineering. The Commission also announced its appointment of John C Beebe as administrator of its San Francisco regional office. The Commission has designated George H Buck as acting director of its National Defense Power Staff and acting chief of its Bureau of Electrical Engineering; and has designated Frank L Weaver as acting chief of its Bureau of Water Power during Mr Beebe's absence. Mr Tate has resigned to resume the practice of consulting engineering and will become the Washington representative of a

ALCO

ALCO ☼ FIN FUEL OIL HEATERS

CONTRIBUTING TO VICTORY BY CONSERVING METAL

Type ATWT Oil Heaters

Buy Alco ☼ Fin Fuel Oil Heaters • High Thermal Efficiency • Small Installation Space Required

Every Part Readily Cleanable

Write for Bulletin No. 1029

AMERICAN LOCOMOTIVE COMPANY
ALCO PRODUCTS DIVISION
30 CHURCH ST., NEW YORK, N. Y. **DUNKIRK, N. Y.**

CONSERVE YOUR FUEL OIL

BY TREATING IT WITH **KIL-SLUDG**

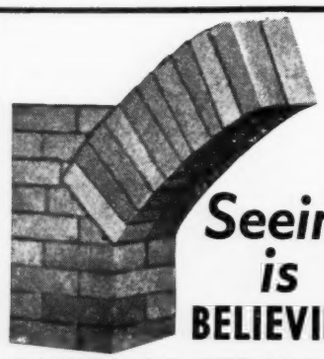
Eliminate sludge conditions in tanks, pipe lines and preheaters with KIL-SLUDG and assure complete combustion of fuel oil.

KIL-SLUDG—specially compounded for effective treating of fuel oil—reduces viscosity of sludge so that full heat value of oil is assured, fuel cost reduced and exeessive smoke and soot conditions eliminated.

TRY IT TODAY!

Send trial order at once advising the nature of the sludge problem you want to solve. Ask for further details.

STANDARD CHEMICAL CO.
NATICK, MASS.



Seeing is BELIEVING

JOINTS AS STRONG AS THE BRICKS THEY BOND

This unretouched photo shows a section of an arch with bricks laid-up with

ADAMANT Fire Brick Cement

Bonding strength of 800 lbs. per sq. in. at room temperature — 1270 lbs. per sq. in. at 2600°F., as proved by impartial laboratory tests. This means much longer furnace life, with fewer shutdowns for re-linings. Write for data.

BOTFIELD
REFRACTORIES COMPANY

784 S. Swanson St., Philadelphia, Pa.
In Canada, Canadian Botfield Refractories Co. Ltd. 171 Eastern Avenue, Toronto

Boston engineering and construction firm. He became associated with the Federal Power Commission in 1933 as Director of the National Power Survey, and was subsequently made chief of the Commission's Power Resources and Requirements Division. Mr Tate was appointed director of the National Defense Power Staff which was created pursuant to the President's directive to the Commission June 14, 1940, and was later made chief of the Bureau of Electrical Engineering.

CHARLES C PHELPS Co announce removal of their office from 98 Park Place to 39 Cortlandt St, New York, N. Y., where they will continue as sales representatives for Nicholson steam traps, Ellison instruments, Dexter valve reseating machines and other engineering specialties.

THE ADVERTISING COUNCIL, INC, 60 E 42nd St, New York, N. Y., expanded its board of directors recently with the election of Mr Mason Britton, vice-president of McGraw-Hill Publishing Co, and Mr Bennett Chapple, assistant to the president of the American Rolling Mill Co. Mr Britton will represent the general business paper field on the Council, while Mr Chapple will represent the industrial phase of advertising work on the Council Board.

GENERAL ELECTRIC Co, Schenectady, N. Y., has announced that S N F Hedman has been appointed designing en-

MEETINGS

American Association for the Advancement of Science—*Summer Meeting, June 22–26, Ann Arbor, Mich.*

American Institute of Electrical Engineers—*Summer Convention, June 22–26, Drake Hotel, Chicago, Ill.*

American Society of Heating and Ventilating Engineers — *Semi-Annual Meeting, June 24, Hotel St. Paul, St. Paul, Minn.*

American Society of Mechanical Engineers—*Semi-annual meeting, June 8–10, 1942, Hotel Statler, Cleveland, Ohio. Oil and Gas Power Division Meeting, June 17–19, Peoria, Ill. Applied Mechanics Division Meeting, June 19–20, Massachusetts Institute of Technology, Boston, Mass.*

American Society of Refrigerating Engineers—*Spring Meeting, June 7–9, Skytop Club, Skytop, Pa.*

American Society for Testing Materials—*45th Annual Meeting, June 22–26, Chalfonte-Haddon Hall, Atlantic City, N. J.*

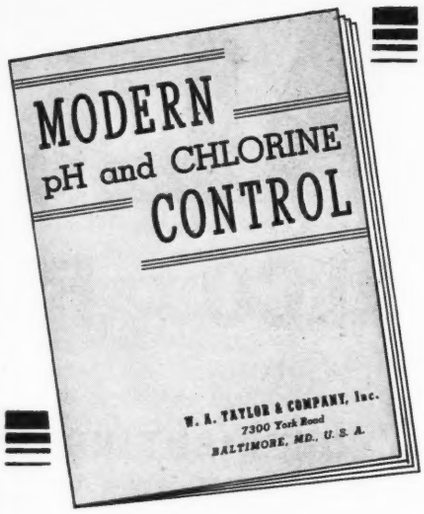
Edison Electric Institute—*Annual Convention, June 1–4, 1942, Atlantic City, N. J.*

Eastern Photoelasticity Conference—*15th Annual Meeting, June 20, University Club, Boston, Mass.*

National District Heating Association—*33rd Annual Meeting, June 11–12, The Dayton Biltmore, Dayton, Ohio.*

Society for the Promotion of Engineering Education—*50th Annual Meeting, Columbia University, New York, N. Y.*

Technical Association of the Pulp and Paper Industry (Tappi)—*27th Fall Meeting, September 30–October 1, 1942, Hotel Statler, Boston, Mass. National Headquarters, 122 East 42 St, New York, N. Y.*



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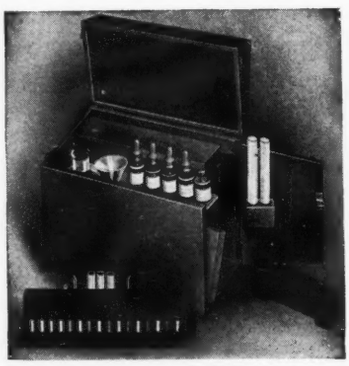

For pH and Phosphate in Boiler Water

This portable outfit is made in two models—Model P for control of phosphates and Model W for control of both pH and phosphates. Accurate liquid color standards carry an unlimited guarantee against fading. Low in cost—only $25 for Model P outfit.

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YORK & ROGERS FORGE RDS. • BALTO, MD.

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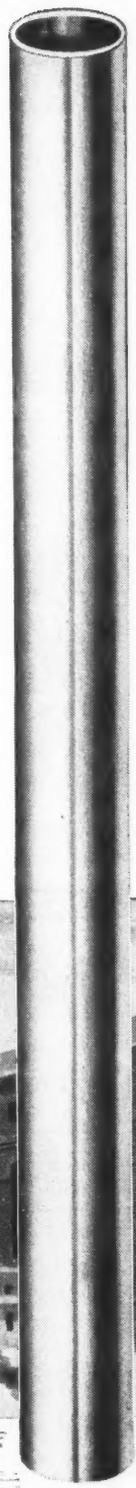
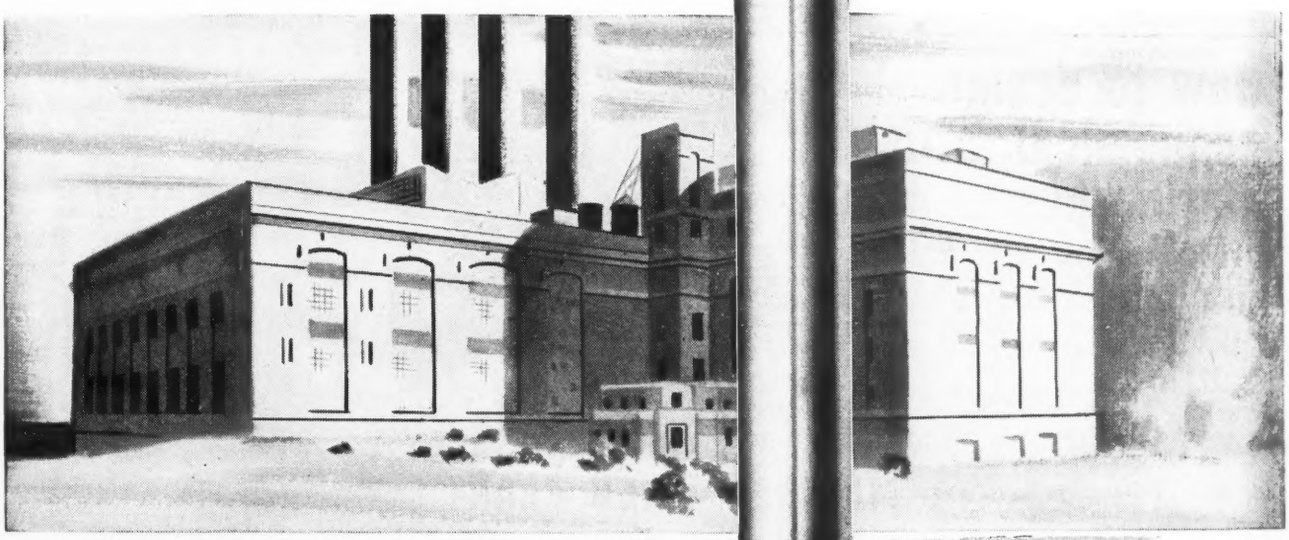
Service records in many of the nation's noteworthy power plants — their use by leading railroads, industrial and marine boiler builders — attest the greater value, safety and savings of Globe Steel Tubes.

Their extra margin of safety and strength — particularly vital to meet modern high pressure and temperature demands — more than offsets any immediate advantage of lower first cost.



Globe engineers are always available to assist in selecting a tube with the exact characteristics you require.

GLOBE STEEL TUBES CO. **MILWAUKEE, WIS.**



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- Condenser and Heat Exchanger Tubes
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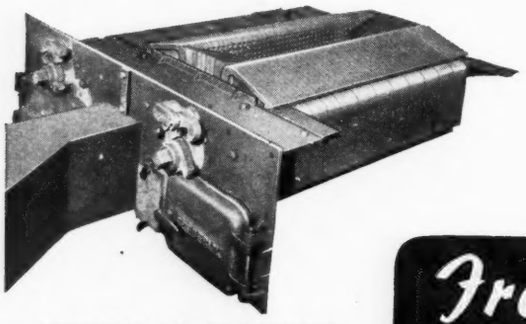
This burning-end is the means of solving many common stoker problems!

FULL ACTIVE GRATE SURFACE WITHOUT DEAD PLATES•
Frederick Stokers have tuyeres of very special design, with air ports so arranged and proportioned as to insure correct air distribution and maximum combustion.

TUYERES ARE LOCKED IN PLACE
—can't be removed without removing the locking rod—can't be raked up inadvertently.

We carefully analyzed stoker faults . . . engineered the re-designed line of FREDERICK STOKERS to correct them! Just a few of the new features can be shown here; for full description of these and the many others — write us today.



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is a Frederick - engineered feature. Simplifies and makes a neater installation—eliminates danger of high efficiency loss through leaking brickwork.

CONVENIENT DOUBLE CLEAN-OUT
gives easy access to both sides of the under grate area. Permits thorough cleaning, faster.

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COMPLETE LINE OF CENTRIFUGAL PUMPS FOR ALL PURPOSES
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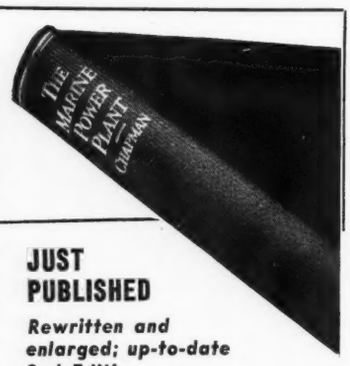
How to design economical, efficient marine power plants



This book gives an engineering treatment of marine power plant equipment, the requirements of applying it economically and efficiently, and design methods, calculations, and data—in concise, clear form, with many details and pointers to help both the engineer who wishes a quick introduction to the working fundamentals of this field, and owners, seagoing engineers, and others interested in effective selection and use of machinery.

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All these features to give you better working knowledge of plant equipment, layout, design, and operation

- stress on fundamental principles, thermodynamic and economic features of marine power plant, plus description of boilers, drives, auxiliaries, etc., methods of employing them, and design calculations and data
- treatment of fuels and combustion, including Diesel oils, pulverized coal, factors of increasing efficiency, etc.
- comparison of all important types of propulsion machinery, on all points affecting engineering and economic effectiveness for particular installations
- complete design procedure and calculations for typical marine power plant steam systems; one for ship fitted with steam auxiliaries and one for ship fitted with motor driven auxiliaries and using extracted steam for feed heating
- section on thermodynamics for those requiring review of this background

THE MARINE POWER PLANT

By **L. B. Chapman**, Professor of Marine Transportation and Marine Engineering, Massachusetts Institute of Technology.
402 pages, 6 x 9, 130 illustrations, $4.00

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gineer of the mechanical drive section of the Turbine Engineering Department of the River Works. Hedman succeeds R G Standerwick, who is relinquishing his position in the turbine engineering department, to devote all of his time in another department. In the same company H C Clement has been made assistant to the district manager of the New York district. Mr Clement's period of continuous service with G E dates from Feb, 1910, when he was employed by the lighting sales division as a salesman in the New York district.

PEERLESS PUMP DIVISION OF THE FOOD MACHINERY CORP, Los Angeles, announces the acquisition of the Sterling Pump Corp, Hamilton, Ohio, and Stockton, Calif. Peerless will consolidate the Sterling plant at Hamilton with the new Peerless manufacturing plant at Canton, Ohio. The Sterling Stockton, Calif., plant will be merged with the John Bean Mfg Co, division of the Food Machinery Corp, San Jose, Calif.

TUBE TURNS, Louisville, Ky., has opened a branch office in Houston, Tex. This office, located in Room 1707, Commerce Building, will be managed by W B Whenthoff, formerly in charge of the Tube Turns office in Tulsa, Okla. The company also announces the appointment of W E Geiser as district manager of the Philadelphia office in the Broad Street Station Building. Mr Geiser has been connected with Tube Turns since 1929.

CONSOLIDATION COAL CO has announced the appointment, effective April 1, of Philip R Grossman as man-

ager of the Philadelphia office in the Broad Street Station Building. Mr Grossman has covered the Philadelphia territory in a sales capacity since he joined the company in 1920.

THE FARRELL BIRMINGHAM CO of Ansonia, Conn., has awarded the general contract for the construction of its

Due to direct war orders and the necessity of conserving critical materials for more essential war work, W-K-M Co. has discontinued the manufacture of Scrubbers for "the duration" — sorry

Grant D. Bradshaw

A contact with a manufacturer who has an outstanding product and wishes to increase its sales nationally

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Fusol removes carbon from preheating unit . . . . eliminates sludge from oil tank . . . . keeps entire system free of carbonaceous materials. Better atomization and hotter flame result from uniform oil. Non-injurious to metals. Fusol must work or you don't pay. Write for information.

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PRECISION GAGE GLASSES and GAGE GLASS GASKETS THAT WILL NOT BLOW OUT

Standard Square Cut Gaskets High Pressure Non-hardening and Non-softening

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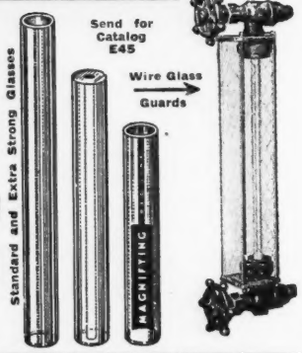
Send for Glass and Gasket Chart

Shipment made by parcel post the same day as order is received



ERNST WATER COLUMN & GAGE CO.
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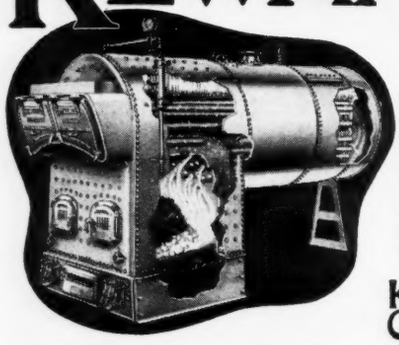
Extra Strength . . . for Heavy Duty

KEWANEE



FIRE BOX BOILERS

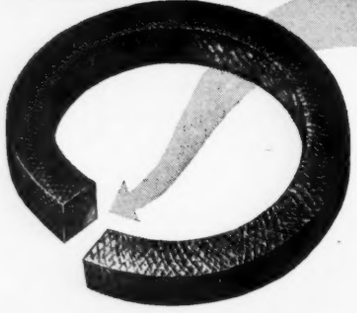
Every characteristic which makes firebox type boilers especially adaptable for Hi Pressure Steam will be found in Kewanee Heavy Duty Series. Sizes for 4 to 300 Horse Power . . . 100, 125 and 150 lbs. W.P.

For 6" rule with scale for outside diameter of pipes, write Dept. 96 K-VI.

KEWANEE BOILER CORPORATION Kewanee, Illinois

THIS PERMANENT SEALING FEATURE COMES ONLY IN

SEA-RO NEK-SEAL PACKINGS



Once in the stuffing box and set up at proper tension, Sea-Ro Nek-Seal Packing No. 505 will function without further care.

The patented Nek-Seal fillet is an exclusive Sea-Ro feature. It prevents any escape of pressure or liquid through the gland. This packing forms a fine bearing surface when in operation, reducing wear and eliminating scoring of rods.

If high temperatures, pressures or speeds are giving you packing trouble, write us about it. There's no obligation.

SEA-RO PACKING CO., INC., WOOD-RIDGE, N. J. SEA-RO

new plant in northern New York to the Turner Construction Co. Plans call for a one-story structural steel, brick and glass manufacturing building, together with an office building, power house and cafeteria. Beeman and Candee are mechanical engineers.

JENKINS CONVEYORS CO was recently organized by D A Jenkins, formerly president of National Conveyors Co, at New York, to specialize in the design, manufacture and installation of pneumatic systems for conveying ashes and metal chips. The company headquarters is located in East Orange, N. J.

THE ALLEN-BRADLEY CO announce the removal of the Chicago office to new quarters at 624-630 W. Adams St, Chicago. Mr John McC Price continues in charge as district manager.

THE RAYON DIVISION OF E I DU PONT DE NEMOURS & CO has developed a rayon tow for use in braided mechanical packing for marine and industrial machinery. It was designed to serve in place of European flax which has become scarce and expensive because of war-time shipping difficulties. Tested for nearly a year in a number of plants, the new product has been found as efficient or better than flax in certain types of installations. The tow is manufactured in continuous lengths and is said to consist of several thousand filaments fibres. It is wound on tubes in 8-lb packages and can be used on braiding equipment formerly employed in braiding flax packing.

The Thirty-third Annual Meeting of the NATIONAL DISTRICT HEATING ASSOCIATION will be held at the Dayton Biltmore Hotel, Dayton, Ohio, June 11 and 12, 1942.

To facilitate the handling of government business, GOULD PUMPS, INC. whose main office and factory is in Seneca Falls, N. Y., has established a Washington, D. C., office, with J B Darden in charge. The new office is located at 505 Colorado Building, 14th and G Sts, Washington, D. C.

The INDUSTRIAL UNIT HEATER ASSOCIATION, at the annual meeting in Detroit, elected E W Petersen president; A B Donkersley, vice-president; and L O Monroe, secretary-treasurer for the coming year.

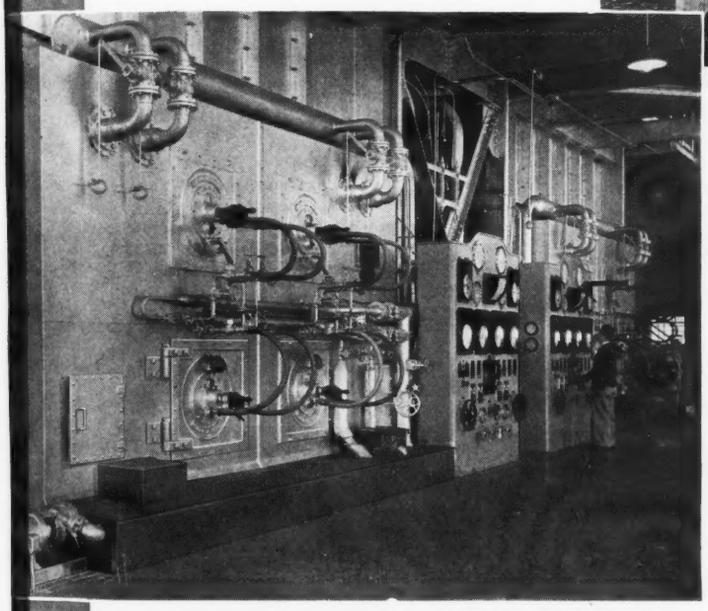
Because of the heavy demands the war is imposing upon electric utility companies, the regular annual convention of the EDISON ELECTRIC INSTITUTE will not be held this year, it was an-

Standby to Hydro!

PEABODY
WIDE RANGE BURNERS

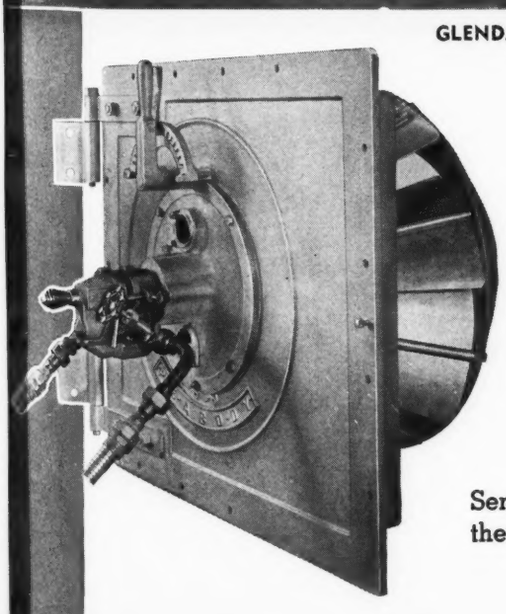
Provide Immediate Load Pick-up

BOULDER DAM



GLENDALE CITY PLANT

The Southern California area is normally served with power generated at Boulder Dam. Should this supply be interrupted or become inadequate at any time, there would be no stoppage in continuous service, for several central stations, equipped with Peabody Combined Gas and CD (*Constant Differential*) Wide Range Oil Burners would pick up the load instantly.



PEABODY WIDE RANGE BURNERS are in hundreds of plants which normally provide high kilowatt output, yet must be ready to handle load variations adequately and economically. These burners have established a new and higher standard of performance over an unbelievably wide range of capacity—when required, in excess of 50 to 1.

Send for new bulletins which describe Peabody Wide Range Burners and the CD Wide Range System fully. If you have a combustion problem, tell us your requirements and get our recommendations.

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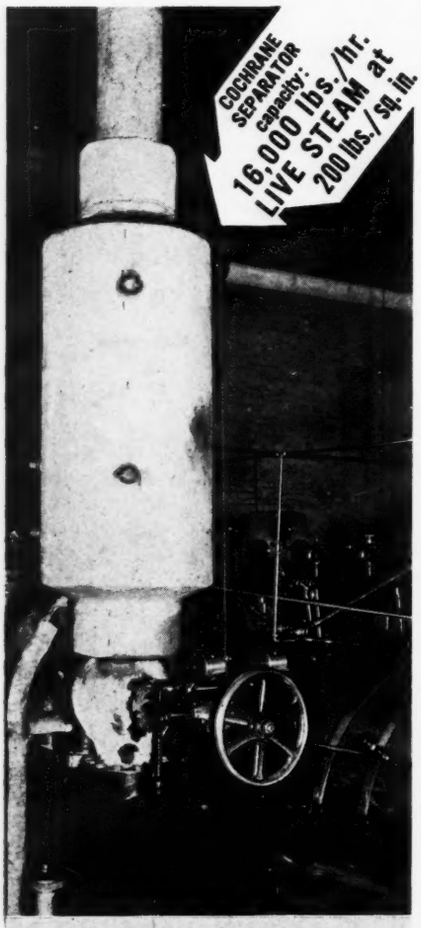
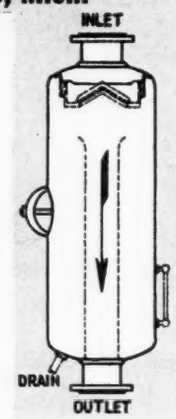


COCHRANE 6" RECEIVER SEPARATOR
on Steam Line to High-Speed Engine at ALLIED PAPER MILLS Kalamazoo, Mich.

Cochrane Receiver Separators have a large well or receiver which serves as a reservoir which equalizes the flow through the steam pipe, maintaining a higher and more uniform pressure in the steam chest of the engine.

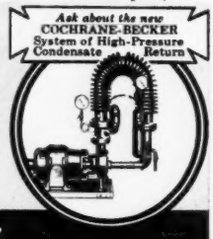
The separator shown in the photograph, at the Allied Paper Mills, Kalamazoo, Mich., is a 6" Fig. 17 Cochrane Receiver Separator, designed to handle 16,000 lbs. of live steam per hour at 200 lbs. per sq. in. pressure.

Cochrane Separators are made in many different styles to suit many different purposes.



COCHRANE CORPORATION
3123 N. 17th St. Philadelphia, Pa.

Rapidly removes hot condensate from steam process equipment and returns it to boiler at high pressure and close-to-process temperature. IMPROVES QUALITY, INCREASES PRODUCTION, CUTS COSTS.



Cochrane

nounced recently by the president, C W Kellogg. The annual convention had been scheduled for the first week in June at Atlantic City.

Stevens Starts Year Round Wartime Program

Stevens Institute of Technology, Hoboken, N. J., is now operating twelve months a year for the duration. Each year will be divided into three 16-week terms, beginning late in September, 1942, and January and May, 1943. Each accelerated service student in good standing will be expected to spend two terms each year studying on the campus and one term each year working in a war industry. These work periods will be staggered through the year so that when a man comes back to college, a classmate will always be ready to take his place on the job. Two of these work periods will be 17 weeks long and the third 18 weeks, so that the industrial service of each class will be continuous. To keep the boys from getting stale, they will get the usual legal holidays and each student on the campus will get a ten-day Christmas vacation, a week in May at the end of the spring term and two weeks in August to break the summer term.

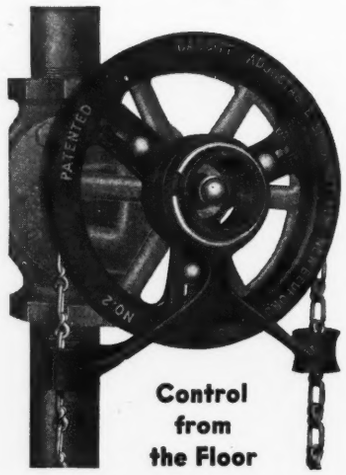
Announcing this new program, Dr Harvey N Davis, president of Stevens, urged this year's new freshmen to report for work on July 6 for a twelve-week orientation term devoted half to the Stevens Engineering Camp and half to campus work in engineering drawing, descriptive geometry and shop practice. This orientation training is designed to help the freshmen perform effective, even though humble, technical services in war industries during the first work period next fall.

Comparing the Stevens plan with the "four years' work in three" plan of some other technical schools, Dr Davis stressed the fact that the Stevens plan makes an immediate contribution to the war work program in 1942, which may prove to be a crucial year. Meanwhile, he said, each of these new freshmen can look forward to completing a sound engineering education in the normal four years with plenty of chance for the maturing process that is so essential a part of a college training.

The accelerated service plan will be put into effect next fall, not only for the new freshmen of the class of 1946, but also for the classes of 1945 and 1944, already in college. It will not be applied to the class of 1943.

The administrative setup necessary for the operation of the plan is such

Make Your Overhead Valves SAFE And Easy to Reach---



Control from the Floor

With the Babbitt Rim for Valves you eliminate danger and banish the step-ladder. You can now place your valves wherever they come economically and conveniently. They fit any valve. Let us tell you more about them. Write today.

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Space Saving Possibilities

The
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OIL PUMP

is exceedingly simple and compact.

Because of absence of valves, gears and reciprocating parts it can be directly coupled to run at motor or turbine speeds. There is no vibration or pulsation.

It handles any oil against any pressure.

Ask for Catalog 1-95.

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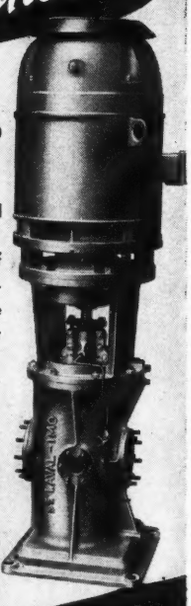
Lube oil service pump; 300 g.p.m. of 130 SSU oil from 10 in. Hg. suction to 50 lbs. per sq. in. at 1150 r.p.m.

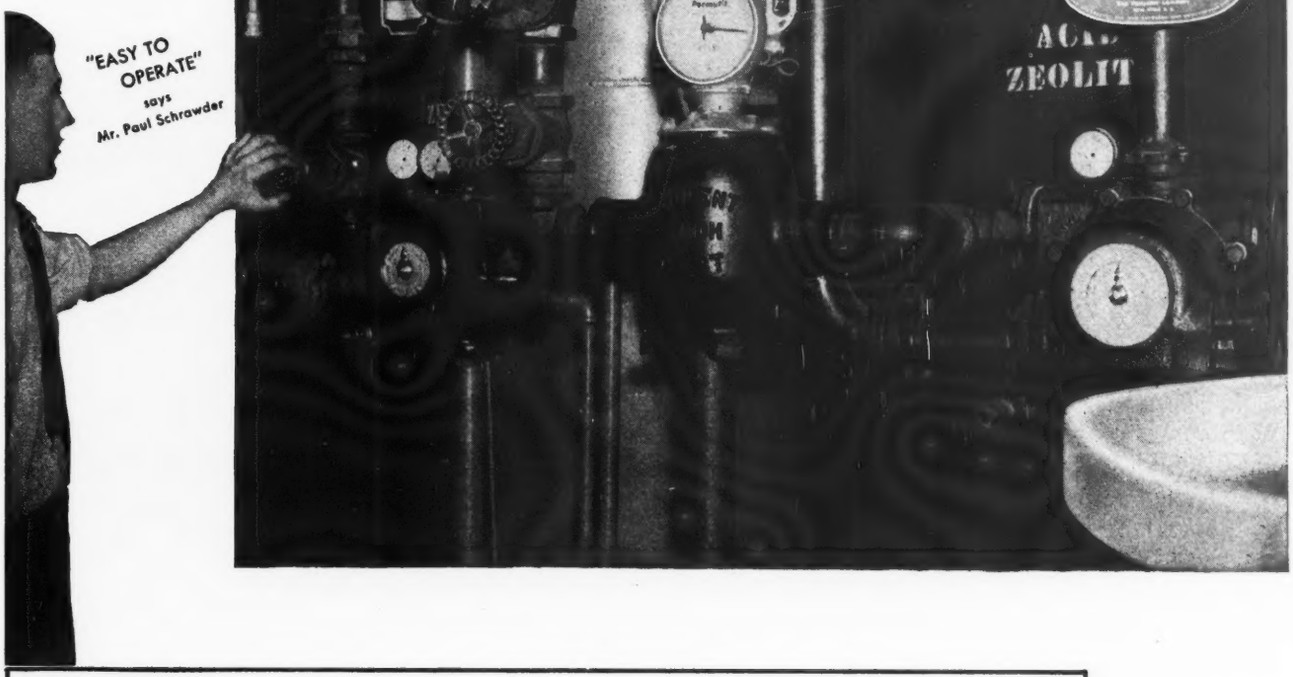


IMO PUMP DIVISION
of the
De Laval Steam Turbine Company
Trenton, New Jersey

PEABODY LIMITED, LONDON

NO BOILER SCALE CORROSION PRIMING

reports Allentown Steam Heating Company



PERMUTIT* Softeners, Deaerators and Blow-off give complete protection

The Allentown Steam Heating Co., Allentown, Pa., heats stores, theatres, residences and office buildings. They use saturated steam at 120 lb. pressure, do not return the condensate but feed boilers with 100% makeup which, before treatment, had a hardness of 157 ppm., alkalinity of 137 ppm. Hardness caused scale and sludge in boilers. Alkalinity gave off carbon dioxide, giving a low pH value to the condensate and causing corrosion in return lines.

At the suggestion of Cyrus Wm. Rice & Co., Inc., their consultants, they installed Permutit Zeo-Karb H and Na softeners, Spray-type Deaerating Heaters and Continuous Blow-off equipment. Mr. Ray Schrawder, Chief Engineer, reports that, after operating a full season without priming, they had *no scale, no corrosion—"boilers clean and like new metal."*

Whereas analyses of the condensate had previously shown free CO_2 in excess of 70 ppm., a pH of 5, and over 1 c.c. of oxygen per litre, with Permutit conditioning a condensate was produced of 1—2 ppm CO_2 and zero oxygen—which has stopped corrosion in users' condensate lines.

Get feedwater treatment that solves your own problems! Permutit makes every type, can advise you impartially. For free booklet, write to The Permutit Company, Dept. A, 330 West 42nd Street, New York, N. Y.

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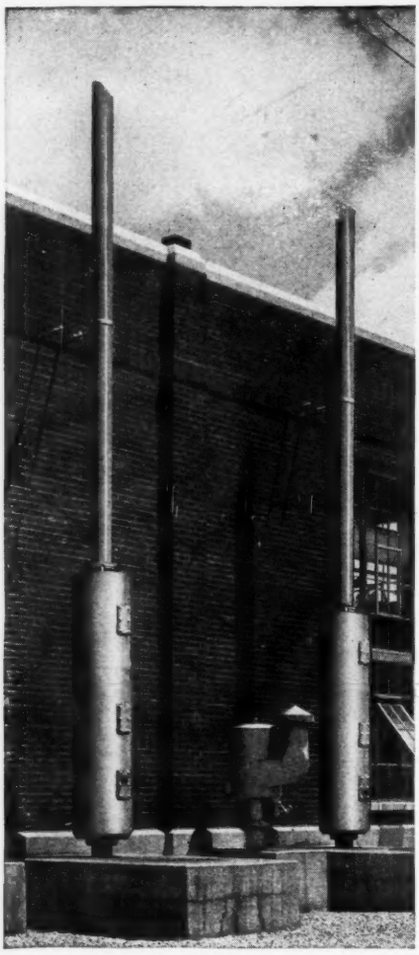
WATER CONDITIONING HEADQUARTERS

A SIMPLE WAY TO ELIMINATE EXHAUST RACKET



MAXIM SILENCERS are the result of long and technical engineering research yet it requires no engineer to operate MAXIM exhaust silencers. Day and night, year after year they perform their silent duty, effectively . . . and without maintenance.

There's no need to put up with distracting exhaust racket or destructive vibration when it is so simple to eliminate them with Maxims . . . built for steam discharges, internal combustion engine intakes and exhausts, and compressor intakes. Write Maxim for recommendations. The Maxim Silencer Co., 92 Homestead Ave., Hartford, Conn.

MAXIM
SILENCERS

that every essential course in the curriculum will be available in each term of each year. It should be noted that Stevens faculty recently voted to require at least 30 weeks of approved work useful to the war effort as a prerequisite for graduation.

Relatively Scarce Materials Listed

The second in the series of provisional reports on the relative scarcity of certain materials, prepared by the Conservation and Substitution Branch of the Bureau of Industrial Conservation, was made public today. The first report was issued March 12.

Harvey A Anderson, chief of the branch, pointed out that many changes have been made since the first report and that many more items have been included. The major addition to the list is in materials for building construction.

The arrangement of the list is the same as in the first report; that is, in groups according to their availability for substitution or use in civilian industry. Mr Anderson emphasized that the status of the listed materials, and others as well, is constantly changing in relation to supply and demand.

Group 1, the branch chief noted, is made up of materials that generally are critically essential for the prosecution of the war. For these materials, civilian industry must largely find substitutions or anticipate stoppage of manufacture of articles containing them. Chemicals derived from scarce metals are, in general, of the same order of scarcity as the metals.

Group 2 comprises materials also necessary for war production and essential industrial activity, but the supply is not so severely restricted. Necessary civilian industry may obtain limited supplies from this group, when specific cases are sufficiently urgent.

Group 3 includes materials that are more available for substitutions, although in no case, it was stressed, can the supply be considered unlimited, since other factors than the material itself may determine the amount available.

The metals in group 1 include: alloy steel, aluminum, aluminum scrap, cadmium, calcium-silicon, chromium, cobalt, copper, copper scrap, iridium, iron alloys, magnesium, nickel, nickel scrap, rhodium, tin, tinplate and terneplate, tungsten and tungsten carbides, vanadium, wrought iron and zinc (high grade).

Miscellaneous products in the same

ROCKWELL Blast Gates are better designed, combine light weight with strength and are carefully machined and tested. They close airtight and have graduated dials for accurate setting and resetting.

Made in all types—slide, kwikleen, butterfly and wafer, with lever, handwheel and chain wheel control—there's a Rockwell Blast Gate for every requirement. Write for catalog 4020, W. S. Rockwell Co., 50 Church Street, New York.

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BLAST GATES

SAFE TRACTION
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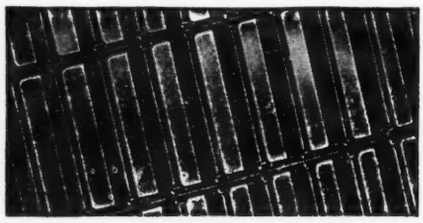
ELECTRICALLY PRESSURE WELDED

Non-slip, sharp top edge, self-cleaning cross bars like the ridge of a roof give you the maximum in safe traction. Other features your Batesgrate dollars buy are —maximum open area for light and air— no grooves or rough burned metal to catch grease or dirt—fillet weld, the strongest type—no cracks, joints, or crevices, therefore, easily maintained—smooth, clean appearance. Get all the important details from Catalog No. 937—Write today.



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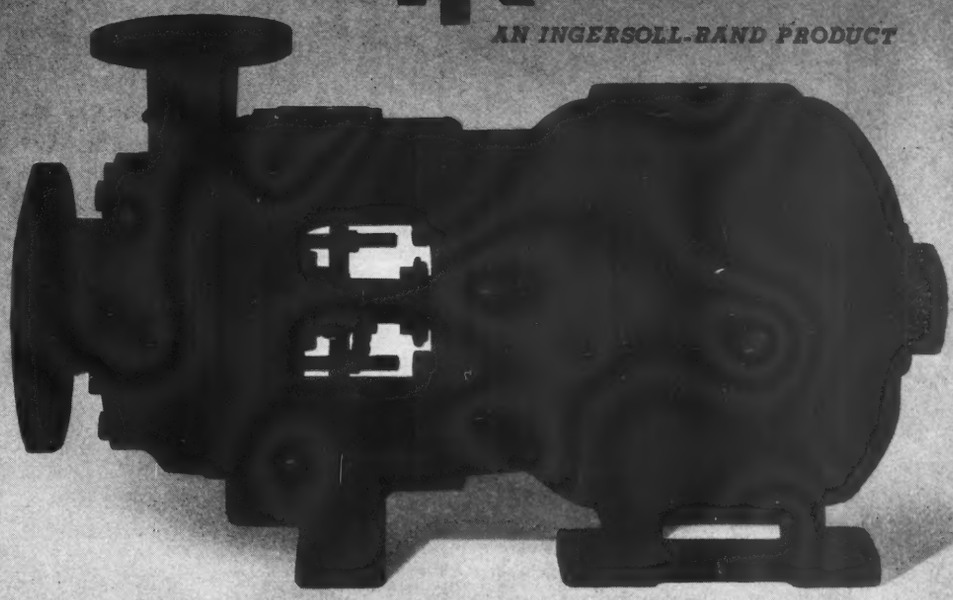
THE CAMERON

MOTORPUMP

AN INGERSOLL-RAND PRODUCT

Design and construction details in a pump are of the utmost importance. Upon them depend pump efficiency, length of service, freedom from trouble and ease of maintenance.

Careful attention to details has in a large measure been responsible for the outstanding success of the Ingersoll-Rand Motorpump. Some of these details are show below. Let our engineers discuss the Motorpump with you. Capacities 5 to 1800 gpm; heads to 500 feet.



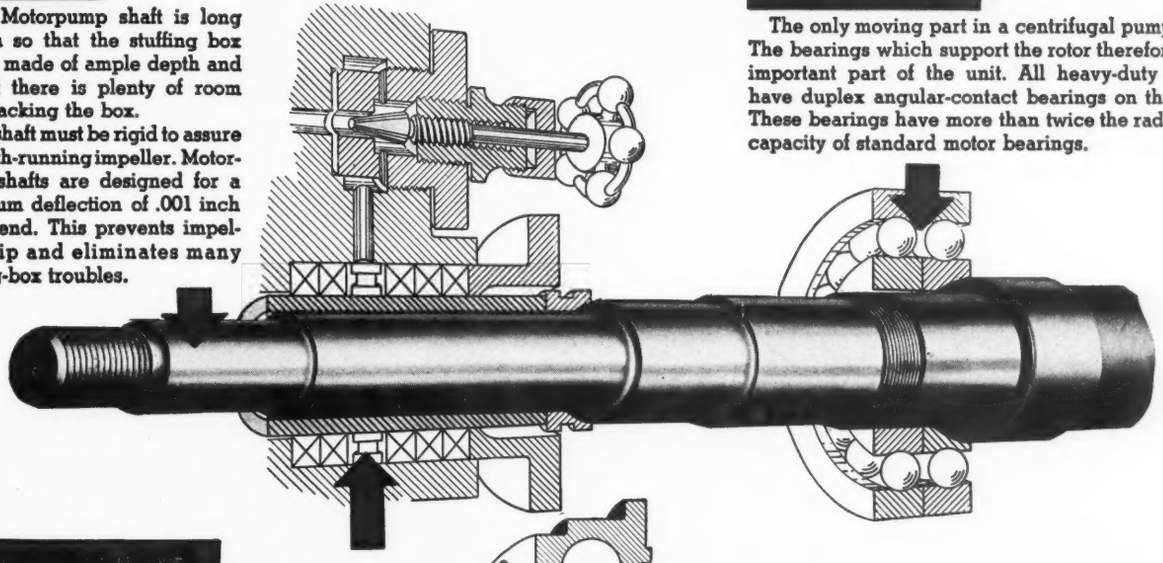
[redacted]

The Motorpump shaft is long enough so that the stuffing box can be made of ample depth and so that there is plenty of room for repacking the box.

The shaft must be rigid to assure a smooth-running impeller. Motorpump shafts are designed for a maximum deflection of .001 inch at the end. This prevents impeller whip and eliminates many stuffing-box troubles.

[redacted]

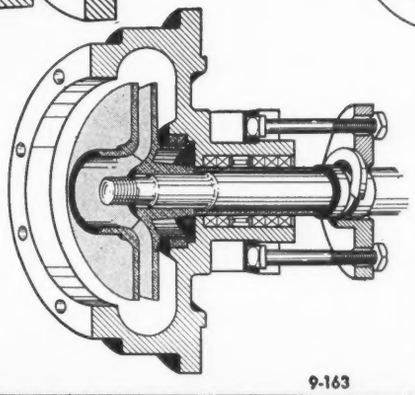
The only moving part in a centrifugal pump is the rotor. The bearings which support the rotor therefore, are a most important part of the unit. All heavy-duty Motorpumps have duplex angular-contact bearings on the pump end. These bearings have more than twice the radial and thrust capacity of standard motor bearings.



[redacted]

The stuffing box on the Motorpump holds sufficient packing to permit accurate control of the sealing action. In addition a sealing gland is placed in the box, except for liquids requiring special packing. When the pump handles water the liquid for this gland is taken from the casing. Its flow is controlled by a needle valve. External seals are provided when handling liquids which can not be used in the sealing gland.

There is ample room to repack the stuffing box, and a convenient split gland is provided.



[redacted]

In order to facilitate the removal of the impeller, and shaft sleeve, a patented impeller puller is incorporated on heavy-duty Motorpumps.

This consists of a slotted sleeve on the shaft in which a yoke may be inserted. When the suction nozzle and impeller nut are removed, the impeller can easily be pushed off by tightening the stuffing-box gland against this yoke.

9-163

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Cameron Pump Division

Branches or Distributors in other Principal cities the world over.

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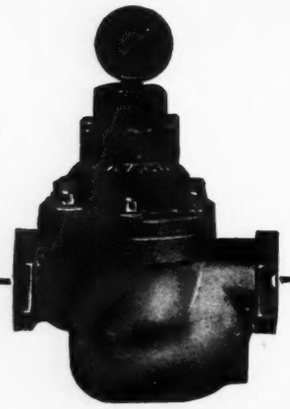

BUILT to ACCURATELY METER HARD-TO-MEASURE LIQUIDS

Henszey Feed Water Meters accurately measure boiler feed water, hot dirty blowdown, condensate, free running chemicals, and many other liquids that cannot be satisfactorily measured by ordinary meters. They are equally accurate at high or low flow, high or low pressure, on reciprocating, duplex, triplex or centrifugal pumps. Sizes range from 10 g.p.m. to 1200 g.p.m. cold water steady flow rating. Pipe connections ¾" to 6". Calibrations can be made to read in gallons, pounds, or cubic feet at any specified temperature. The meter is easily installed right in the line.

Check your meter requirements today. Send for complete information stating your specific problem if possible. No obligation for unbiased recommendations.

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BOILER FEED WATER
METERS

group include long-fiber asbestos, burlap, corundum, Madagascar graphite, hemp (Agavè fiber, manila fiber, cordage and seed), jewel bearings, kapok, mica splittings, rubber (crude, latex, chlorinated, and synthetic), and sperm and tung oil.

Welding Contest

In order to get valuable information about arc welding to factory executives in a hurry—Hobart Brothers Co has added a "Welding Ideas For Victory" division to their regular $200 monthly Arc Welding News Contest. Acting as a clearing house for defense welding ideas, this division will prepare and release to the general public all welding ideas judged worthwhile to our offense production.

There has been no limitations placed on the number of prizes to be offered every month for "Welding Ideas For Victory." The company promises, however, to purchase and publicize immediately every worthwhile welding idea.

Send ideas for victory to "Offense Ideas," Hobart Brothers Company, Troy, Ohio. Reports on the value of items sent in will be mailed back promptly.

Conservation Poster

James P Marsh Corp has produced a poster dealing with the conservation of vital materials. This is finished in red, white and blue and makes an attention-getting display. Companies or individuals desiring a single copy or quantity of the poster should communicate with the James P Marsh Corp, 2073 Southport Ave, Chicago, Ill.

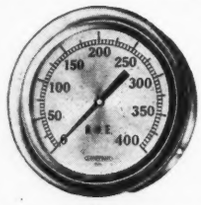
Eight Westinghouse Men Receive Service Medals

George H Bucher, president of the Westinghouse Electric and Manufacturing Company, presented the Westinghouse Order of Merit for distinguished service to eight employes at the East Pittsburgh works.

Voted by the company's Board of Directors, medals were awarded to A S Wentworth, R E Marbury, A H Bakken, H N Blackmon, L E Schumacher, J B George, T J Schrimser and Edward Griffiths.

Each of the eight received a bronze medal bearing his name, a silver "W" and the inscription, "Whom his fellow men delight to honor." Since its inception in 1935, the Westinghouse Order of Merit has been awarded to about 200 employes for outstanding contributions

As Accurate and Practical and as can be made



—It's true of this "BOE" Steam, Air and Pressure Gauge ... true of all Lonergan safety appliances. They are carefully designed for maximum accuracy and service . . . Each part GUARANTEED to be made from the best materials with unexcelled workmanship.

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70th Anniversary

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MANUFACTURERS OF PRECISION

Valves • Gauges
Specialties

J. E. LONERGAN CO.
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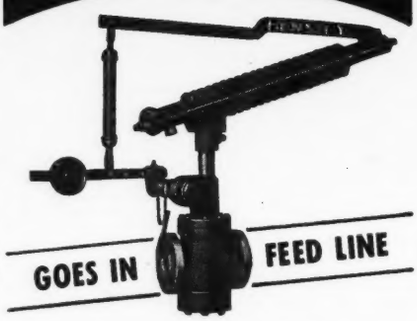
HENSZEY
BOILER FEED
REGULATORS

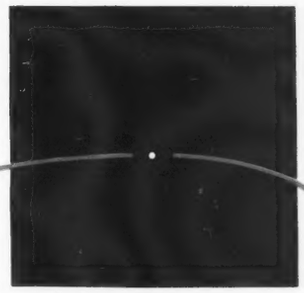


The Henszey Boiler Feed Regulator controls boiler water levels continuously and accurately under *all* load conditions!

These simple, compact, self-contained units go right in the feed line and require no additional structural support. They are as easy to install as a simple gate or globe valve. Once installed and set for operation no further attention is necessary—nothing to get out of order—nothing to reset.

Send for latest Bulletin containing full details.

HENSZEY COMPANY
Dept. D6—Watertown, Wis.



YOU CAN POUR THREE TONS OF COAL THROUGH THIS 1/32" HOLE!

HOFFMAN NO. 8A TRAP
A low pressure trap with removable, interchangeable Thermal Unit. Ideal for radiators.
HOFFMAN VENTING VALVES
Air and vacuum types. Vacuum Valves feature famous Hoffman Double Air Locks and leak-proof construction.
HOFFMAN 50 SERIES TRAP
A heavy duty unit with all working parts mounted on the cover—can be serviced without breaking pipe connections. Parts subject to wear are reversible or renewable.

Not literally, of course. But a steam leak, no bigger than a pin hole, will during a year's operation, waste the equivalent of this amount of fuel.

Isn't this fact an urgent reason for checking your own heating equipment? Leaky traps, worn-out valves, aged, ailing pumps may be building up a huge and needless fuel loss.

Hoffman Steam Specialties are prime favorites with thousands of experienced heating engineers who have economy records to maintain. They base their preference on three "dollars and cents" points—

First, *design* which assures full utilization of heat produced in the boiler.

Second, *constructions* which permit inexpensive replacement of the parts in which long usage has caused wear.

Third, *no premium price!*

Therefore, Hoffman Specialties are sound investments all through their life—when bought, when used, and when repaired. The Army, the Navy, and Industry, in war or peace, are large users of Hoffman products. The rigid requirements of these services are ample evidence of merit.

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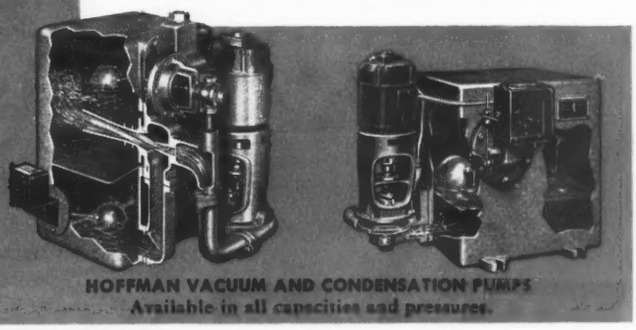
1001 York St., Indianapolis, Ind.



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VALVES . . TRAPS . . VACUUM AND CONDENSATION PUMPS

Sold everywhere by leading wholesalers of Heating and Plumbing equipment

CHECK YOUR HEATING PLANT EQUIPMENT NOW . . . SEND FOR HOFFMAN STEAM SPECIALTY BULLETINS

XZIT

FIRE SCALE & SOOT ERADICATOR

...reduces deposits in all types of boilers using all kinds of fuel ...speeds cleaning ...increases efficiency

XZIT—a scientific, proved chemical compound—definitely reduces carbon deposits on boiler heating surfaces, uptakes, breechings and stacks. While not a substitute for blowing or brushing, XZIT greatly increases the efficiency of these operations and reduces their frequency. XZIT not only makes it easier to remove carbon deposits but tends to prevent further accumulation of soot and fire scale. It is harmless to metal or brick and prevents sparks and stack fires.

OFFSETS EFFECTS OF INFERIOR FUELS

XZIT is effective regardless of the type of boiler or the kind of fuel used. It is ideal for use where fast carbon-deposit-forming fuels are used. It provides a valuable method of counteracting the soot-forming and efficiency-lowering conditions resulting from todays necessity for using inferior fuels.

TRY XZIT AT OUR EXPENSE

A thorough trial with XZIT will prove its value. We will gladly supply a sufficient quantity for test with no cost or obligation unless you are thoroughly satisfied with results. ACCEPT THIS TRIAL OFFER TODAY. You'll quickly prove the value and economy of XZIT just as thousands of other plants have done.

Openings are available for sales representatives in a few desirable territories.

XZIT SALES CO.
1031 CLINTON STREET
HOBOKEN, NEW JERSEY

to electrical and mechanical arts and to their company's progress. Accompanying each medal is a citation describing the recipient's service.

A medal went to Mr Wentworth, manager of the printing and publication division, for "ability and unusual resourcefulness" in coordinating and modernizing Westinghouse printing operations.

As a section engineer in the switchgear division, Mr Marbury holds a number of patents on electrical equipment and was honored by the company for his "advanced engineering ideas" and contribution to apparatus design.

Mr Bakken, who is a mechanical engineer in the circuit breaker department, also won recognition for inventive ability in switchgear equipment, railway and other apparatus and for his "uncanny ability to anticipate in design the needs of a developing art."

In the field of editorial accomplishments, Mr Blackmon was cited for his "outstanding ability to interpret Westinghouse engineering achievements to editors of technical and trade magazines and for his honesty of opinions and ability to teach editorial techniques and philosophy." Mr Blackmon is manager of editorial service, which provides technical publications with articles pertaining to Westinghouse.

Mr Schumacher, organizer of many employe activities and supervisor of the visitors' service bureau at East Pittsburgh, received the award for his "ability to sense and stimulate the interest of employes in group activities: and his "genial and friendly discharge of duties" in the visitors bureau.

An architect in the factory service division, Mr George received the award in recognition of his technical ability and supervision in the erection of superior factory structures and also for services as a consultant.

Mr Schrimser is superintendent of the Benolite Company at Manor, Pa., which is a subsidiary of Westinghouse engaged in the manufacture of varnish. He was honored at the Benolite Works following the luncheon ceremony for his contributions toward the "development of high grade insulating varnishes," for able management and "for noteworthy achievements in varnish chemistry."

Contributions to manufacturing methods and ability to inspire and guide others brought Mr Griffiths, director of time study and methods, into the select group of award winners.

Water Power Report

The Dominion Water and Power Bureau, Surveys and Engineering Branch,

Send for this **FREE DIGEST**

A DIGEST OF
28
essential maintenance jobs generally performed in factories and mills and on which Oakite materials are being successfully used to save time, money and effort.

It's NEW! It's TIMELY... tells how 28 essential power plant maintenance jobs can be handled EASIER and FASTER!

War conditions are multiplying maintenance problems of every power plant, central station and public service company. Here in this Digest you will find data on 28 different jobs, each one based on the successful experience of many plants. On each is outlined the method followed, the Oakite material used, the advantages gained, the time saved.

You will have many of these maintenance jobs to do in your plant. Here is your opportunity to benefit by what others have discovered to speed-up this essential work and increase efficiency in handling these jobs.

Write for Your Copy Today!

Time is at a premium these critical days. This Oakite Digest points out proved ways to save it and conserve man-hours for other work. Address us on your business letterhead and your **FREE** copy will go forward immediately. Send for it today!

OAKITE PRODUCTS, INC.
23 Thames Street, New York, N. Y.
Representatives in All Principal Cities of the United States and Canada.

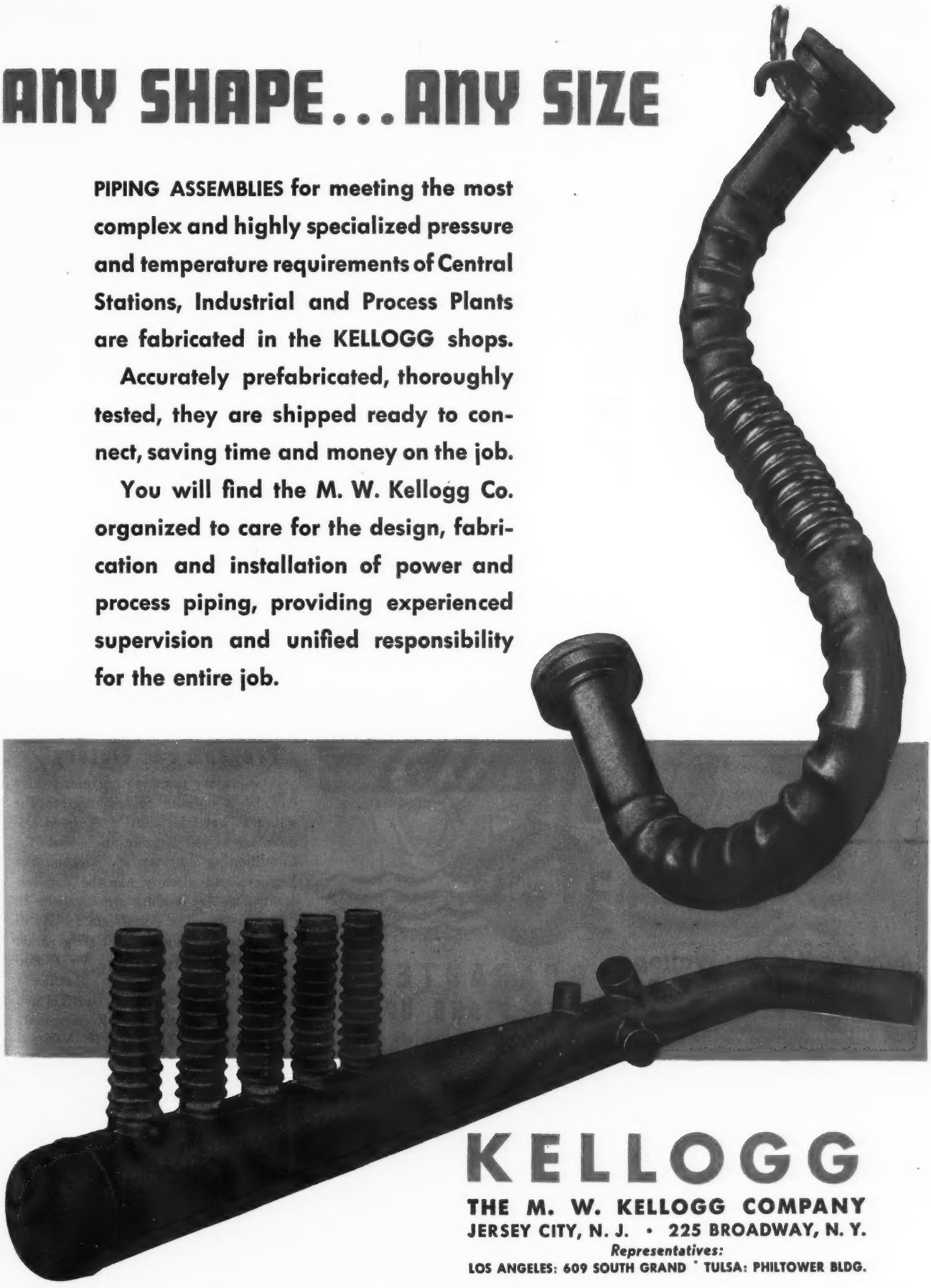
OAKITE *Specialized cleaning*
MATERIALS & METHODS FOR EVERY CLEANING REQUIREMENT

ANY SHAPE...ANY SIZE

PIPING ASSEMBLIES for meeting the most complex and highly specialized pressure and temperature requirements of Central Stations, Industrial and Process Plants are fabricated in the KELLOGG shops.

Accurately prefabricated, thoroughly tested, they are shipped ready to connect, saving time and money on the job.

You will find the M. W. Kellogg Co. organized to care for the design, fabrication and installation of power and process piping, providing experienced supervision and unified responsibility for the entire job.



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JERSEY CITY, N. J. • 225 BROADWAY, N. Y.
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"Masterflex" Prefabricated Piping Systems • "Masterweld" pressure vessels for Power, Refinery and Chemical Industries. Heat Exchangers. Pyrolytic and Catalytic Cracking Units, Reforming, Dehydrogenation, Alkylation, Desulphurization, Thermal and Catalytic Polymerization Units JUIK Processes for Lubricating Oil Plants. Plastic Refractories • Radial Brick Chimneys.

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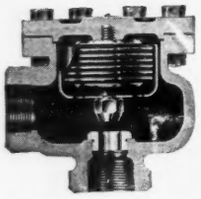
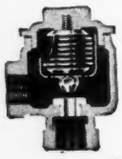
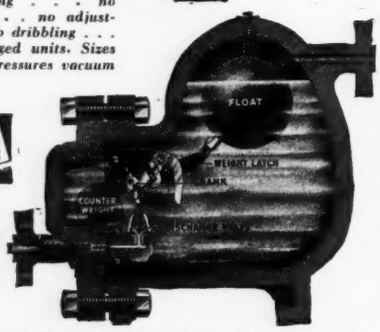
Install NICHOLSON TRAPS for MAXIMUM EFFICIENCY



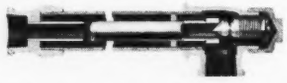


INDUSTRIAL THERMOSTATIC Traps in 4 types. No air-binding . . . no freeze-ups . . . no adjustment . . . no dribbling . . . no water-logged units. Sizes ¼" to 2". Pressures vacuum to 300 lbs.

SEE OUR CATALOG IN SWEET'S



Types for all power and process applications. Piston operated, instantaneous positive action — no wire drawing—pressures 2 to 650 lbs. Weight operated, large capacity—fully automatic—intermittent action—pressures vacuum to 1500 lbs. Expansion type, automatic—continuous discharge—adjustable for pressures to 225 lbs.



WRITE NOW (or clip this ad to letterhead) for Trap Catalog No. 941

Bulletins mailed promptly describing NICHOLSON Compressed Air Traps, Gasoline Traps, Steel and Stainless Steel Floats, Flexible Couplings, 2-3 and 4-way Valves, Compression Shaft Couplings, Expanding Mandrels, Arbor Presses, Steam Eliminators and Separators.

TRAPS • VALVES • FLOATS
COUPLINGS • MANDRELS
ETC.

W. H. NICHOLSON & CO.

125 OREGON STREET
WILKES-BARRE, PENNA.
U.S.A.

There's a Victory Wallop in SMOOTH, TOUGH FLOORS

Let's slap 'em down with production . . . top speed production only possible over smooth, tough floors. Factory floors can't be pocked with ruts and holes and still be efficient. Sturdy patches . . . complete solid overlays can be made quickly with tough RUGGEDWEAR RESURFACER. No chopping or chipping required. Simply mix the material—trowel it on. Bonds tight to irregular edge of old concrete. Cellulose-Processed for more rugged wearing surface. Used indoors or out, Dries fast. Low in cost.

MAKE THIS TEST!

FLEXROCK CO.
2377 Manning St., Phila., Pa.

Please send me complete RUGGEDWEAR information . . . details of FREE TRIAL OFFER —no obligation.

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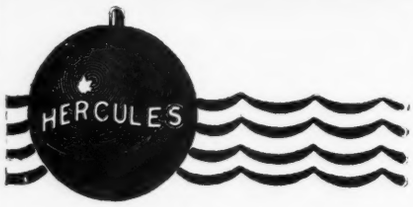
HERCULES
Seamless Copper
FLOATS



GUARANTEED TO STAND UP!

Every Hercules Float carries our guarantee to stand up under 350 lbs. working pressure and 500 degrees temperature.

Fabricated of seamless copper under our special spinning process. Hercules Floats are uniform in thickness and high in mechanical strength.

You can depend on Hercules for floats—in standard shapes up to 10 in. and in special types to your specifications—to give long, dependable, economical service.

Insure care-free maintenance of water level in your heaters, tanks, reservoirs and other equipment by specifying "HERCULES."

HERCULES FLOAT WORKS
200 Franklin St.
SPRINGFIELD, MASS.

Department of Mines and Resources of Canada, has issued its annual review of the water-power resources of Canada, under date of March 16, 1942. This review supplies information in condensed form on the total available and developed water power in each province, the provincial distribution of water power, and progress in its development and utilization in the wartime and ordinary industrial activities of the Dominion. The review also gives information in regard to the growth of water-power development in Canada, the capital invested in industry, the coal equivalent of developed water power, and the resultant saving in coal consumption.

The present recorded water-power resources of the Dominion amount to a total of 20,347,400 hp under conditions of ordinary minimum flow and 33,617,000 hp ordinarily available for six months of the year which corresponds to a potential turbine installation of about 43,700,000 hp. The total turbine installation, as at January 1, 1942, is 8,845,038 hp. It is thus apparent that a large proportion of the water power of Canada still awaits development.

Copies of this review may be obtained on application to the Controller, Dominion Water and Power Bureau, Department of Mines and Resources, Ottawa, Canada.

"Program For Victory"

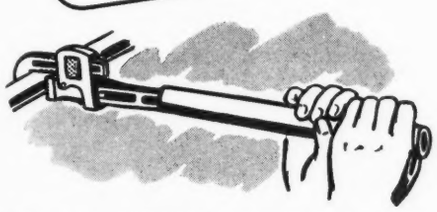
A voluntary conservation plan which can be a notable contribution to the nation's wartime effort has been announced as the Refrigeration and Air-Conditioning Industry's Program For Victory, and already has the endorsement of twelve leading organizations in the industry—The American Society of Refrigerating Engineers, Refrigeration Service Engineers Society, Air Conditioning and Refrigeration Machinery Association, Association of Refrigerated Warehouses, Commercial Refrigerators Manufacturers Association, National Frozen Food Locker Association, Inc, National Association of Ice Industries, National Association of Practical Refrigerating Engineers, Practical Refrigeration Engineers Association, National Refrigeration Supply Jobbers Association, Refrigeration Equipment Manufacturers Association, and the Standard Refrigeration Compressor Association.

The Program For Victory, which specifies practical means of saving, simplifying and substituting materials needed in the war, is the outgrowth of informal conferences between Dr Wil-

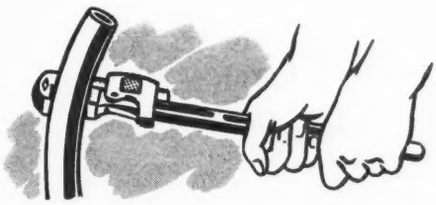
GET MORE USEFUL HOURS

FROM YOUR PIPE WRENCH

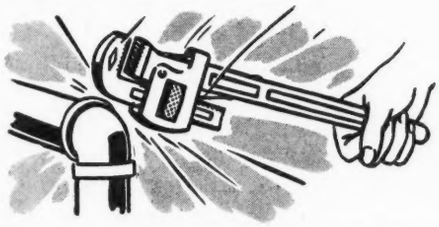
These few suggestions on what to do and what not to do when using a pipe wrench may help to assure the long life that pipe wrenches possess when fairly treated. As manufacturers of the original and genuine Stillson, as well as of the newly improved Walco Pipe Wrench, we offer this advice:



Do not put extended leverage on the wrench handle. The extra load will strain the wrench excessively. Shorter life results.

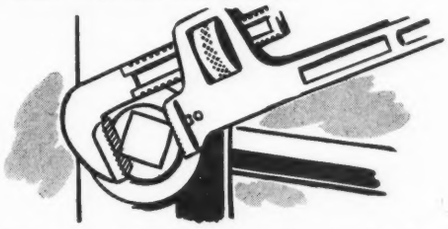


Do not subject the pipe wrench to side strains. Even the strongest pipe wrench will suffer from this wrong usage.



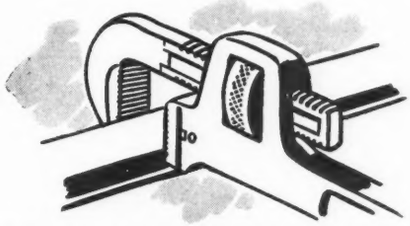
Do not use a pipe wrench in place of a hammer. It is not designed to withstand impact and shock. Use a hammer.

(Incidentally, don't smash fittings. Metal's too precious today.)



Do not apply pipe wrenches on hardened steel objects such as set screws, etc. Such practice causes undue wear on the teeth.

Keep teeth clean. Give them a chance to grip firmly. Dirty teeth cause slipping. Slipping causes wear and, perhaps, accidents.



Do not grip pipe too near the front or too far back in the jaws of the wrench. Careless application causes slipping and wear.

THE "GENUINE STILLSON," "WALCO" AND "PARMELEE" PIPE WRENCHES
ARE MADE BY THE MANUFACTURERS OF WALWORTH VALVES AND FITTINGS

WALWORTH 1842 1942 VALVES AND FITTINGS 100TH ANNIVERSARY

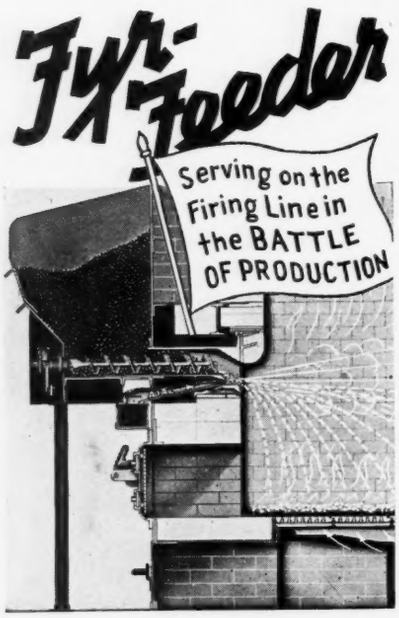
Walworth, the oldest manufacturer of valves and fittings in the United States, scrapped its "institutional" ads planned for its 100th Anniversary in order to present these educational messages in a sincere effort to help users of Walworth products get maximum service.

WALWORTH

WALWORTH COMPANY
60 EAST 42nd STREET, NEW YORK

VALVES
FITTINGS
and TOOLS
Backed by 100
Years' Service

DISTRIBUTORS IN PRINCIPAL
CENTERS THROUGHOUT THE WORLD



"Best Stoker Built!"

HUNDREDS of users of the "up-to-the-minute" *multiple* FYR-FEEDER praise the EFFICIENT, DEPENDABLE, ECONOMICAL service they have been getting ever since changing over to this *most* modern firing system. Engineers say it's the best and finest stoker built and you will agree with them if you install it under your boilers. Why go on with "out-of-date" firing methods when you can have the Multiple FYR-FEEDER Spreader Stoker do a wonderful job for you?

SIMPLE, AUTOMATIC, FOOLPROOF!
BURNS COAL LIKE OIL!

- **FYR-FEEDER means less work for the fireman. Makes firing automatic and E-A-S-Y! Takes all the hard work out of cleaning fires —no clinkers to struggle with—no slice bars need be used.**
- **FYR-FEEDER increases boiler steaming capacity. FYR-FEEDER burns cheapest coal at highest efficiency. FYR-FEEDER uses local coals and saves VITAL transportation facilities now so urgently needed in the War effort. FYR-FEEDER reduces smoke because it produces accelerated or "instant" and perfect combustion.**
- **FYR-FEEDER does a perfect firing job with a thin fuel bed—with never more than an average of a half inch of coal on the grate.**

FYR-FEEDER will help you cut your steam costs. Wire your order for FYR-FEEDER today, or write today for full details.

TERRITORIES FOR SALES ENGINEERS

Some territories are open for experienced sales engineers familiar with steam plant boilers and furnaces. Information on request. Please furnish record of your experience and references.

AMERICAN COAL BURNER COMPANY,
Engineers
32-18 East Erie St., Chicago, Ill.

☐ **YES, I want to know what the FYR-FEEDER can do in our plant.**
☐ **Please mail descriptive literature.**
☐ **I am interested in selling FYR-FEEDERS.**

Name .....

Company .....

Address .....

liam R Hainsworth, president of The American Society of Refrigerating Engineers, and various officials in Washington, including Henry W Dinegar, Division of Civilian Supply, Office of Price Administration. It is expected that official endorsement of the plan will soon be secured from leading WPB officials.

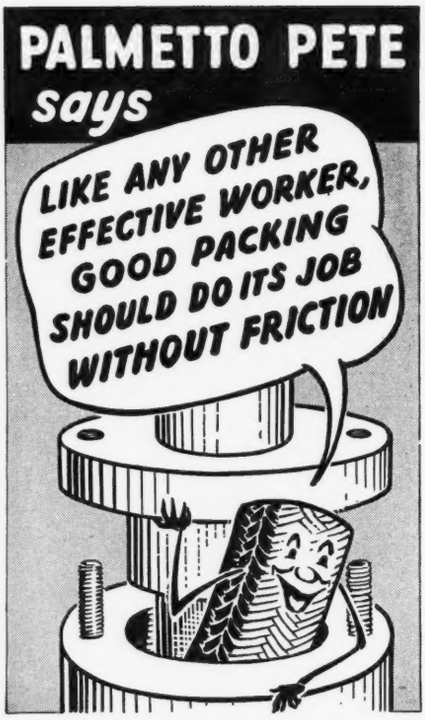
Preliminary two-color folders will be distributed by the ASRE to other cooperating societies and to companies in the industry. Other organizations and companies have indicated that they plan to support the campaign by providing large posters for use in manufacturing plants, distributors' organizations and service firms.

ASRE officers have announced that they have merely started the ball rolling, and that they are aware that many companies and individuals in the field are already following the suggestions outlined. They urge every man in refrigeration and air conditioning to support the victory program 100%, since only by industry-wide support will it be a large-scale contribution to the successful contribution of the war.

Here is a typical pledge, part of the program:

If an operator, maintenance or service engineer, I will . . .

1. Keep machines running efficiently and smoothly. Check performance. Conserve electricity, fuel and power.
2. Find all leaks and repair them as soon as possible. Be sure not to add refrigerant until leak is found and repaired. If necessary, remove refrigerant and transfer it to an approved container. Avoid purging to the air. Check shaft seal. Tighten gasket joints.
3. Check compressor oil level. Oil meter bearings and keep them oiled.
4. Keep motors operating efficiently. Clean commutators and brushes. Replace badly worn bearings.
5. Check belt alignment and tension. Conserve rubber.
6. Blow off condenser surface on air-cooled machines. Be sure that air supply is adequate.
7. Clean condensers on water-cooled machines. Be sure there is no partial stoppage. Be sure that the water valve is set to maintain economical condensing pressure. Clean regulating valve and strainers.
8. Check insulation for moisture, deterioration and tightness. Replace if defective.
9. Make certain that tools and equipment are in good order. Clean and check tool kit.
10. Check stock of parts, fittings and supplies.



It takes *lubricant* . . . a plentiful, continuing supply . . . to keep packing friction down to a minimum. The supply of lubricant in

PALMETTO* PACKING

is both plentiful and continuous, because *each individual strand* in this packing is impregnated with the lubricant under pressure, while hot, before braiding or twisting. In addition, the graphite lubricant is specially selected to stand up under steam and hot water service . . . your assurance of long, satisfactory service from PALMETTO.

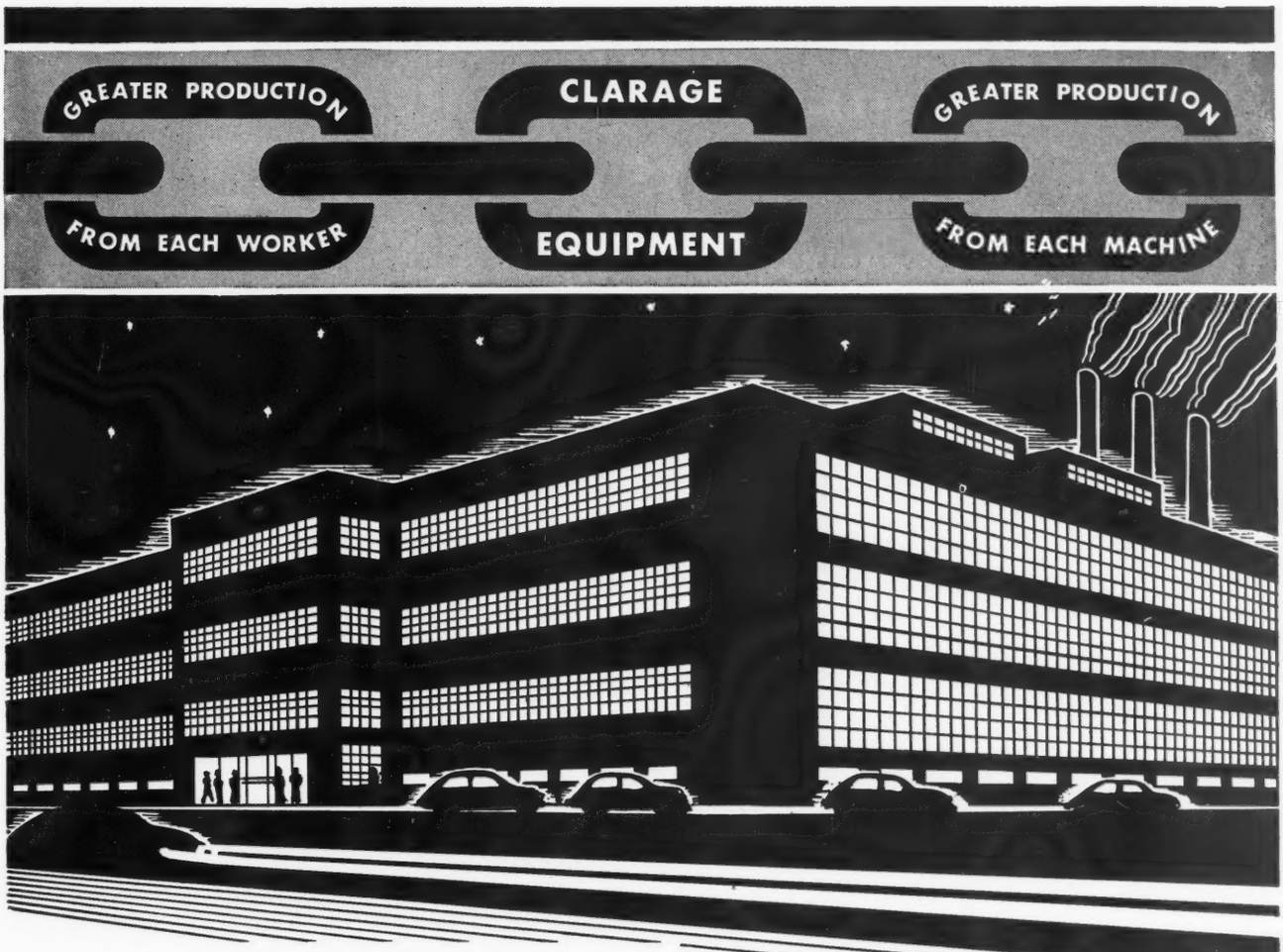
FREE WORKING SAMPLE

Prove the lasting softness of Palmetto at our expense. Just send us your name and address, stating the service for the packing and its size, and a generous sample will be sent you without charge or obligation.

*Reg. U.S. Pat. Off.

GREENE, TWEED & COMPANY
Bronx Blvd. at 238th Street
New York N. Y..

PALMETTO
for steam, hot water, air.
PALCO for water. PELRO for oils. CUTNO for alkalis.
SUPERCUTNO for acids.
KLERO for foods, etc. PALMETTO SUPERSHEAT
PACKINGS



No Plant Effort is ALL OUT with Bad Air Conditions

All that Clarage has in engineering skill and modern plant facilities has been dedicated 100% to war needs. Into war production plants the country over are going Clarage Fans, Blowers, Air Washers, Unit Heaters and Conditioning Units to IMPROVE air conditions – *to insure greater production from each worker and from each machine.*

If you are engaged in high priority work and require any type of air handling or conditioning equipment, we can help you. Our National reputation for trustworthy recommendations and for quality manufacture goes back to World War One.

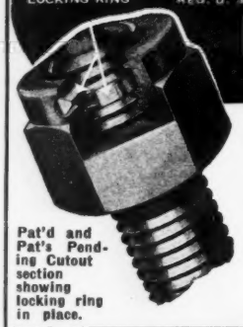
COMPLETE AIR CONDITIONING
•
COOLING
•
VENTILATION
•
FACTORY HEATING
•
MECHANICAL DRAFT
•
FANS and BLOWERS for INDUSTRIAL NEEDS

CLARAGE FAN COMPANY–KALAMAZOO, MICH.
SALES ENGINEERING OFFICES IN ALL PRINCIPAL CITIES

THE UNSHAKO SELF-LOCKING NUT

LOCKING RING REG. U. S. PAT. OFF.

REALLY "STAYS PUT"



Pat'd and Pat's Pending Cutout section showing locking ring in place.

—regardless of vibration. The locking-ring is always on guard . . . automatically prevents backing-off . . . Saves maintenance time and breakdown trouble . . . yet . . . can be readily backed off with a wrench . . . and, it can be used again and again. Write for complete details.

STANDARD PRESSED STEEL CO.

JENKINTOWN, PENNA. BOX 577

—BRANCHES—

BOSTON • DETROIT • INDIANAPOLIS • CHICAGO • ST. LOUIS • SAN FRANCISCO

PYREX Red Lines

CAN ALMOST TALK

Even in a poorly lighted boiler room a PYREX Broad Red Line Gauge Glass will shout for attention.

That's a fact you can prove to yourself. Cut out the illustration at the left. Place it beside any regular gauge glass in your plant. At arm's length or a hundred feet away, the broad red line *stands out.*

With a PYREX Broad Red Line Gauge Glass you are always sure of water-level visibility. And visibility is protected, too, for PYREX brand Gauge Glasses have the qualities it takes for long-life serviceability. Resistance to thermal shock and the corrosive attacks of steam together with machine-drawn accuracy that lessens installation strains help cut your gauge glass costs.

PYREX Broad Red Line Gauge Glasses are stocked by leading mill and steam supply dealers.

At left, a reproduction from an actual unretouched color photograph which illustrates the appearance of the gauge glass from directly in front.

"PYREX" is a registered trade-mark and indicates manufacture by Corning Glass Works.

CORNING Glass Works Corning, New York

Pyrex Gauge Glasses

11. Return empty refrigerant cylinders to suppliers without delay.

12. Give prompt service. Be sure of the diagnosis of trouble. Avoid guesswork. Plan work to save time and tires. Concentrate effort. Avoid repeat calls. Study service manuals and information supplied by manufacturers.

13. Check expansion valve if crankcase runs cold.

14. Remove oil from rubber mounting blocks.

15. Clean evaporator surface.

16. Advertise and publicize my ability and desire to aid in the war-time program.

17. Instruct users in procedure in an emergency.

Silver Busbars

Suggested six months ago almost as a joke, use of silver for busbars in huge new war plants to conserve copper is about to become a reality.

Treasury Department lawyers this week were working out a legal means of using the "free" or unmonetized silver holdings of the government for busbars in probably all the new aluminum plants in the 640,000,000-lb capacity expansion program recently announced, as well as in other new plants. A total of about 40,000 tons of the Treasury bullion is understood to be involved.

Plan under contemplation is to have the Treasury "lend" the silver to the Defense Plant Corp which holds title to the new war facilities. It would be fabricated into regular busbars and other heavy electrical equipment and installed in place of copper parts. After the war the silver would be replaced with copper and returned to the Treasury.

The proposal for doing this bears the sponsorship of the War Production Board and is traceable to Chairman Donald M Nelson directly. It was Nelson who six months ago suggested that because of the tight copper situation and silver's excellence as an electrical conductor that the government monetary hoard could be better utilized as busbars than in the ground at West Point.

Since then the copper situation has become much more critical, so much so that at last week's meeting of the WPB Requirements Committee the supply of red metal found available for non-munitions use in the second quarter equals only 40% of total civilian consumption in the similar 1940 period. Faced with this situation, Nelson initiated serious conferences with Secretary Morgenthau now about to come to a head.

It is understood that only the Treas-

DEARBORN ENGINEER makes certain that your water samples get the

"Third Degree"...

in the main laboratory

• Dearborn chemists are at hand to collaborate with the Dearborn Engineer in solving your problems.

• Of greatest importance to you . . . Dearborn Engineer *lives* and *works* in the district where your plant is located. He knows your local water conditions intimately. He knows when and how to overcome contamination due to seasonal conditions or local industrial pollution. He is the channel through which you get complete laboratory analysis, engineering cooperation, and actual on-the-spot field service in your plant. Especially among power plants producing greatly in excess of normal these days, there is urgent need for the service of Dearborn Engineer. He's a mighty capable specialist to know and rely upon. Drop us a line . . . we'll arrange for him to see you. DEARBORN CHEMICAL COMPANY, Dept. D, 310 South Michigan Avenue, Chicago, Illinois.

Dearborn Engineer does this for you . . .

(1) *Studies* your water and plant operating conditions.
(2) *Sends* samples of your water to main laboratory for analysis.
(3) *Recommends* proper chemical treatment and chemical control methods.
(4) *Supervises* installation of feeding equipment.
(5) *Instructs* your men on water test methods for treatment dosage adjustment and blow-down control.
(6) *Calls* regularly to insure maintenance of recommended conditions.

Dearborn

WATER TREATMENT AND ENGINEERING SERVICE

3 BIG SAVINGS WITH ROPER Rotary PUMPS

SAVE 50% TIME

1

Saving of installation time is a most important need of plants producing for Victory — read what one customer writes "So far the new ROPER has proved the easiest of all to install. In fact the last 6 ROPERS we have installed, we saved 18 hours labor — about 3 hours on each."

SAVE 52% SPACE

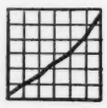
2

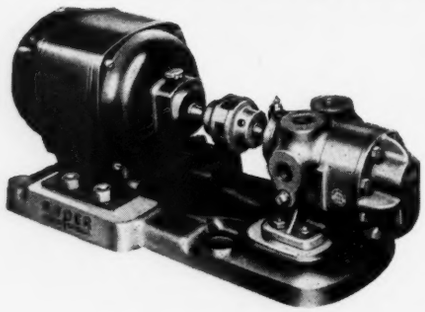
Today with increased production so vital plants welcome opportunities to get efficient equipment that gives them space savings. Roper "direct drive" pumps require only 48% as much floor space as other models.

SAVE 20% POWER

3

Here is another saving important to the Victory program — Roper "hydraulically balanced" Pumps reduce power consumption as much as 20%.





OTHER FEATURES

TIME, space and power savings are most important but remember other outstanding Roper features too! Ropers are "always primed" ready for action; are long on suction lift; quieter in operation; simplest in design — only two moving parts; automatically lubricated; leakproof; and absolutely dependable on long hard jobs.

THOUSANDS IN USE

Roper Rotaries are being used by the thousands in defense plants throughout the U. S. Their dependability and the savings they make possible are vital to all who must handle liquids. Manufacturing and processing industries must have trouble-free equipment — that's why "ROPER" is specified on so many purchase orders.

PUMPING ANY LIQUID

Whether for lubricating systems, general transfer work or for use on intricate hydraulic systems, there is a Roper to do the job. Roper Pumps can be standard fitted, bronze fitted or all bronze—capacities from 1 to 1000 gallons per minute—pressures up to 1000 lbs.—speeds to 1800 revolutions per minute—mountings and drives for every practical need.

HYDRAULICALLY BALANCED

THIS SEAL appears on every ROPER "hydraulically balanced" PUMP. It means higher efficiency, quieter operation, greater dependability and longer life.

Get this valuable Book of Pumping Information

Send for your free copy of catalog. Learn how you can save time, money and trouble.

ask for Catalog No. 944

GEO. D. ROPER CORP., ROCKFORD, ILL.

ury's "free" silver is being considered at this time. The government, however, owns something like 86,000 tons. 40,000 tons of silver bullion, which is understood to be under negotiation, is 3% of a year's copper supply.

Walter Geist President of Allis-Chalmers

Walter Geist, executive vice-president of the Allis-Chalmers Manufacturing Co, has been elected president, succeeding W C Buchanan, who resigned recently because of ill health.

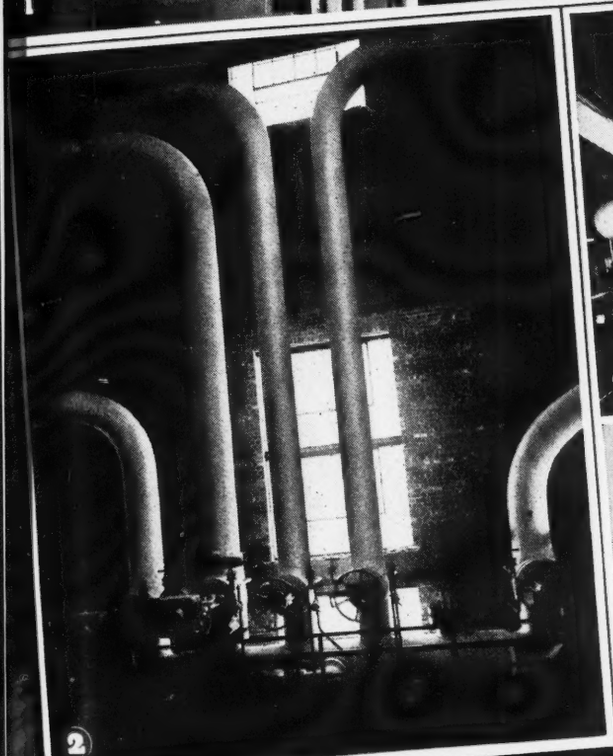
Mr Geist joined the Allis-Chalmers organization in 1909 as an errand boy in the sawmill engineering department. From that job he advanced to tracer, draftsman, designer, accumulating experience and a broad knowledge of the various products of the company as he progressed. When he was 31 he was made engineer in charge of transmission.

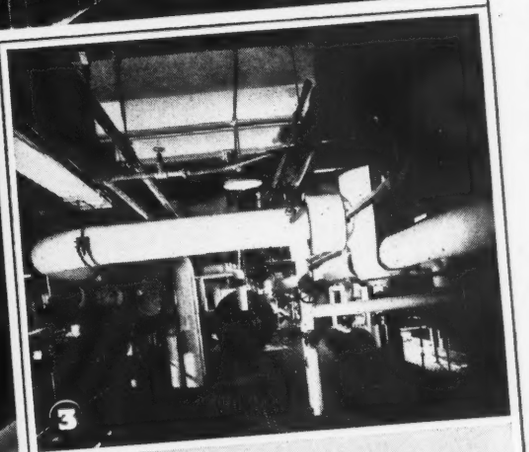
His research in textile mill drives resulted in the development of the multiple-V-belt drive, since known as the Texrope V-belt drive. For his research and original work in the field of power transmission Mr Geist was one of the group of outstanding American inventors who were honored two years ago by the National Association of Manufacturers with the award of the "Plaque of a Modern Pioneer."

In 1928 Mr Geist was made assistant manager of the entire milling department, and in 1933 he was appointed general representative of the Allis-Chalmers Co, in which position he was in charge of the personnel of its 52 district offices, foreign and domestic, all dealers, sales promotion and advertising. In 1939 he was made a vice-president, and in April of this year executive vice-president.

Pre-Fabricated and Erected by MIDWEST

Piping for both power house and waste heat boiler plant of the new Morenci Plant of the Phelps Dodge Corporation was furnished and erected by Midwest. This piping was shop-prefabricated insofar as advanced engineering practices would permit and then delivered to the job in a series of accurate sub-assemblies for rapid erection. Morenci power piping is representative of the work done by Midwest . . . three modern fabricating plants and an erecting organization operating from coast-to-coast.

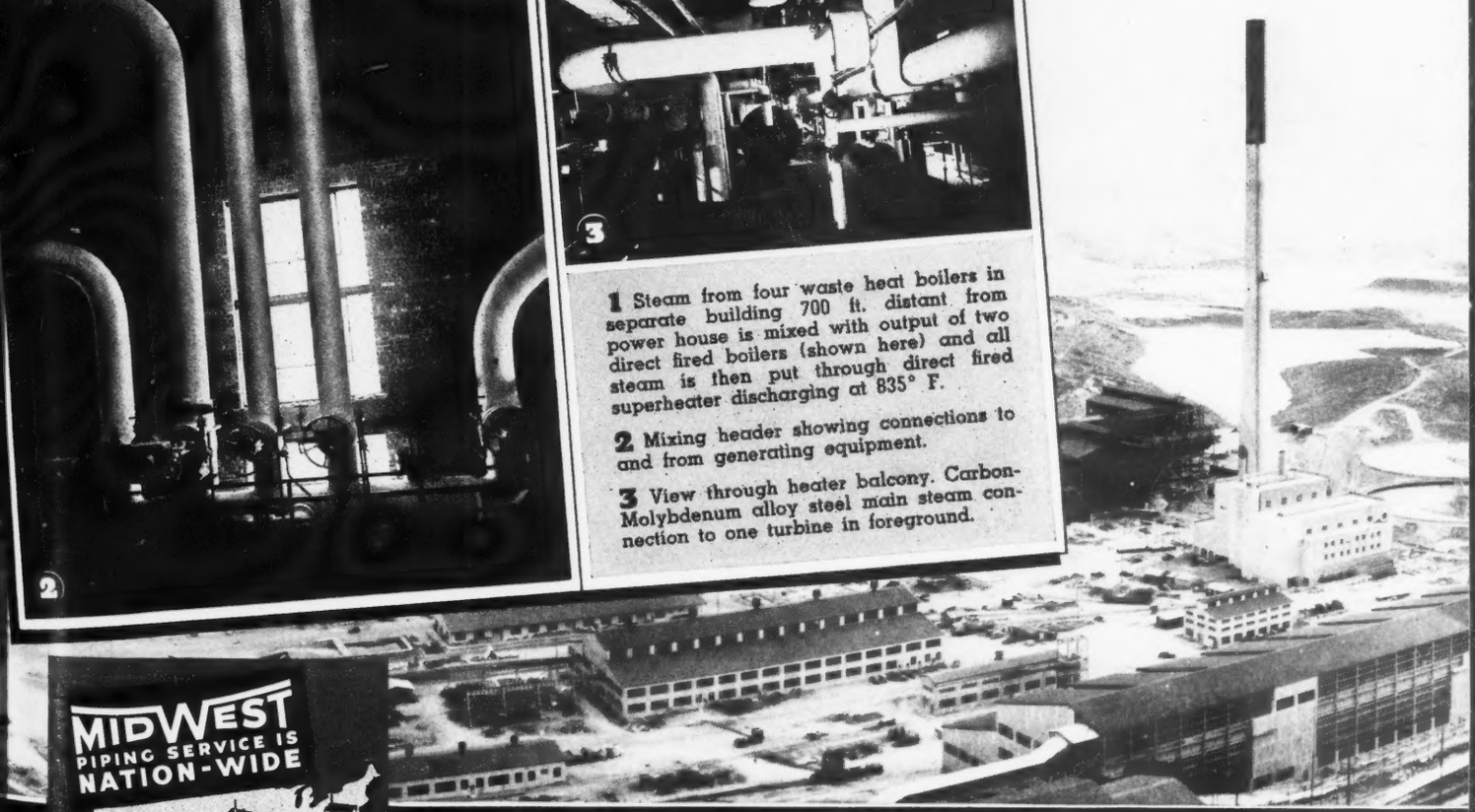




1 Steam from four waste heat boilers in separate building 700 ft. distant from power house is mixed with output of two direct fired boilers (shown here) and all steam is then put through direct fired superheater discharging at 835° F.

2 Mixing header showing connections to and from generating equipment.

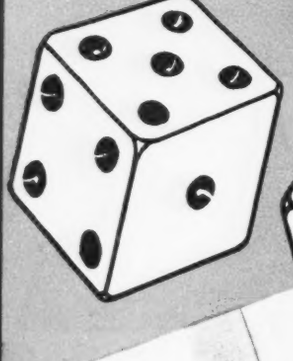
3 View through heater balcony. Carbon-Molybdenum alloy steel main steam connection to one turbine in foreground.

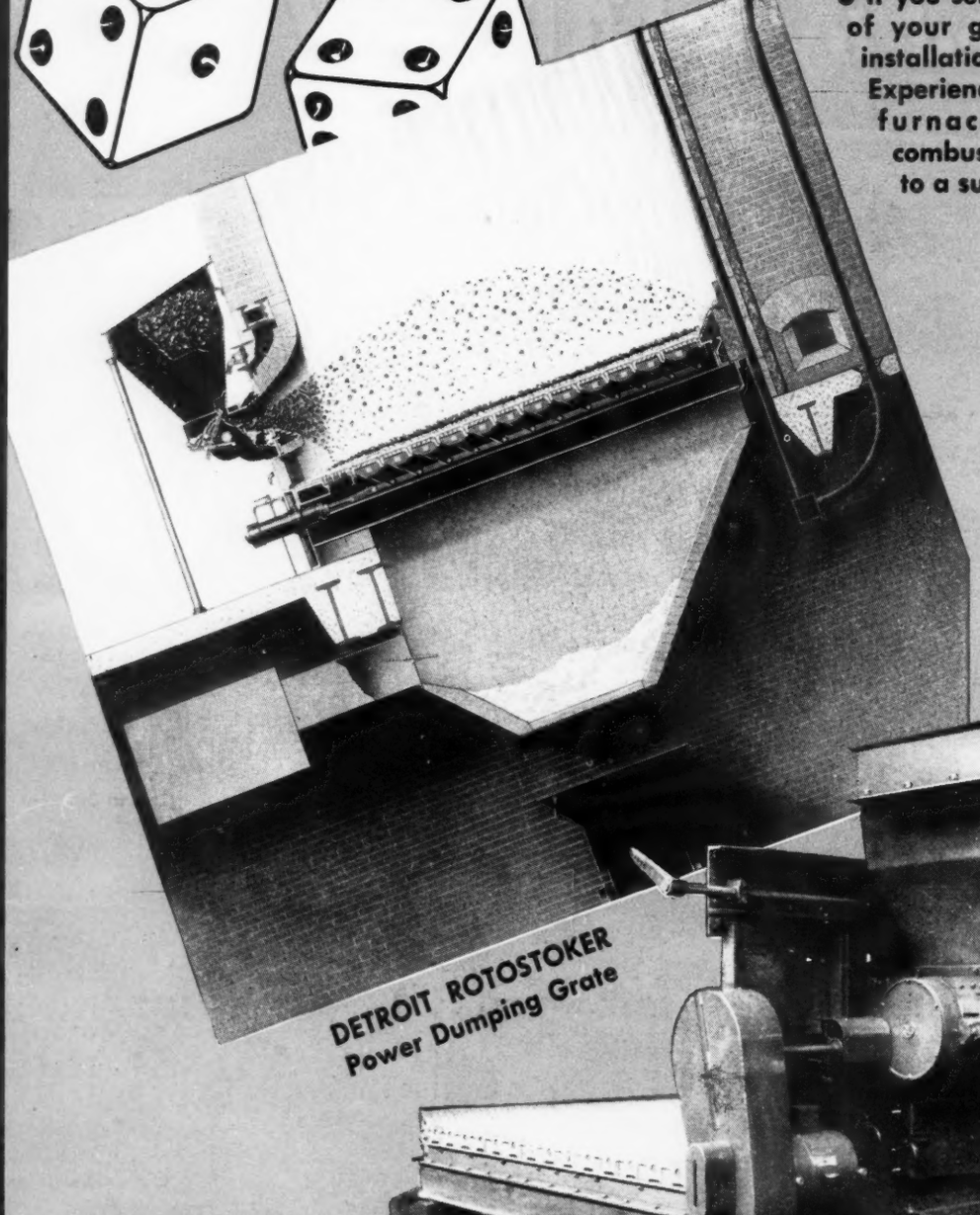


MIDWEST PIPING & SUPPLY COMPANY, Inc.

Main Office: 1450 So. Second St., St. Louis, Mo. Plants: St. Louis, Passaic (N. J.) and Los Angeles
Sales Offices: Chicago—949 Marquette Bldg. • Houston—229 Shell Bldg. • Los Angeles—520 Anderson St.
New York—(Eastern Division) 30 Church St. • San Francisco—535 Call Bldg. • Tulsa—533 Mayo Bldg.

YOU'RE NOT GAMBLING





DETROIT ROTOSTOKER
Power Dumping Grate

● If you select the RotoStoker, there's no chance of your getting an improperly engineered installation. We specialize in Stokers only. Experience enables us to advise you regarding furnace design—fuel burning rates—combustion control, and matters essential to a successful installation.

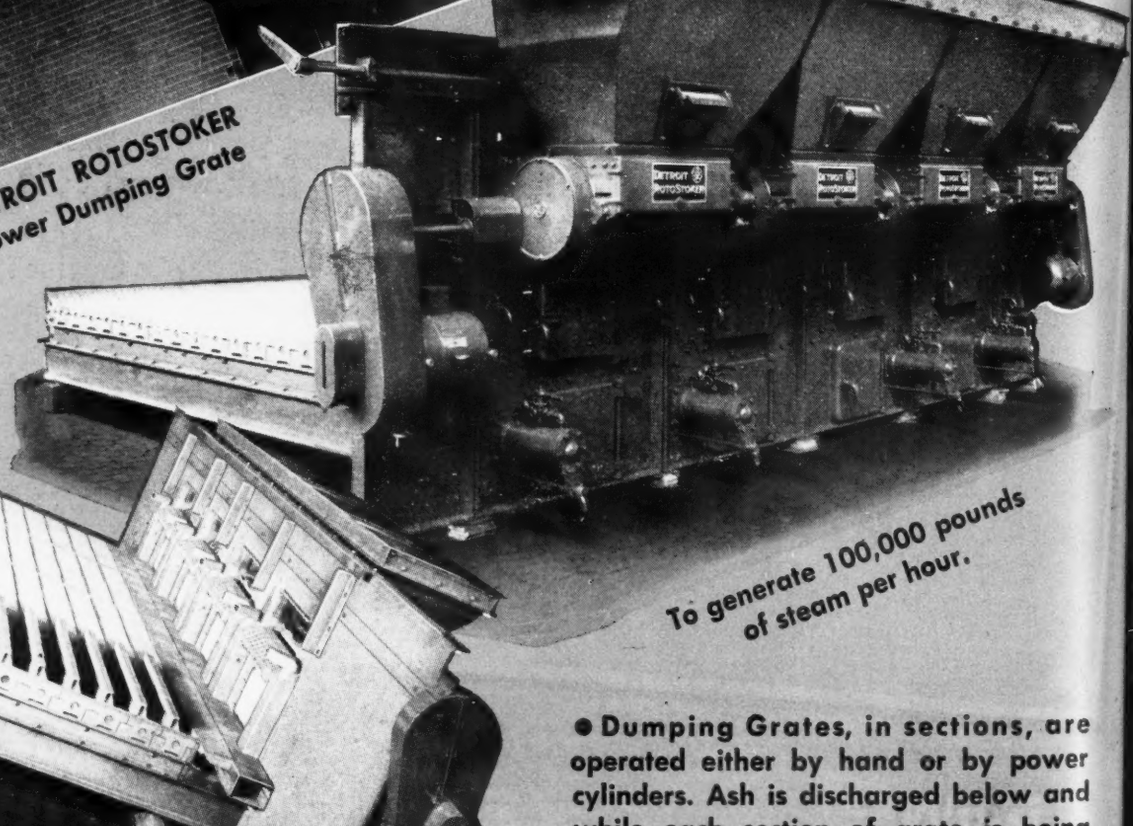
DETROIT ROTOSTOKERS:

Burn a wide range of fuels without special preparation.

Develop high capacities for long periods.

Successfully handle extreme fluctuations of load.

In RotoStoker firing, the fuel is uniformly distributed over the grates by Rotors that throw it *OVER* and into the furnace. Fine particles are burned in suspension, coarse coal on the grates, with a comparatively thin, level fuel bed.



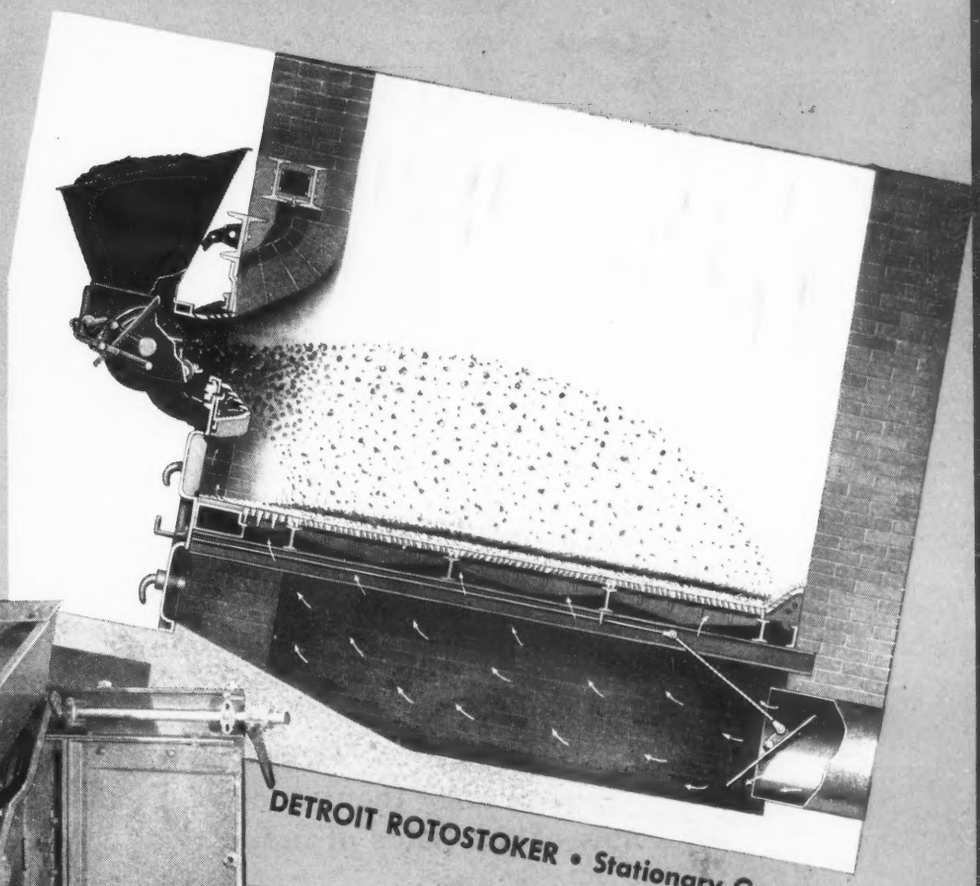
To generate 100,000 pounds of steam per hour.

One section of grates in dumped position.
Simple in design—easy to operate.

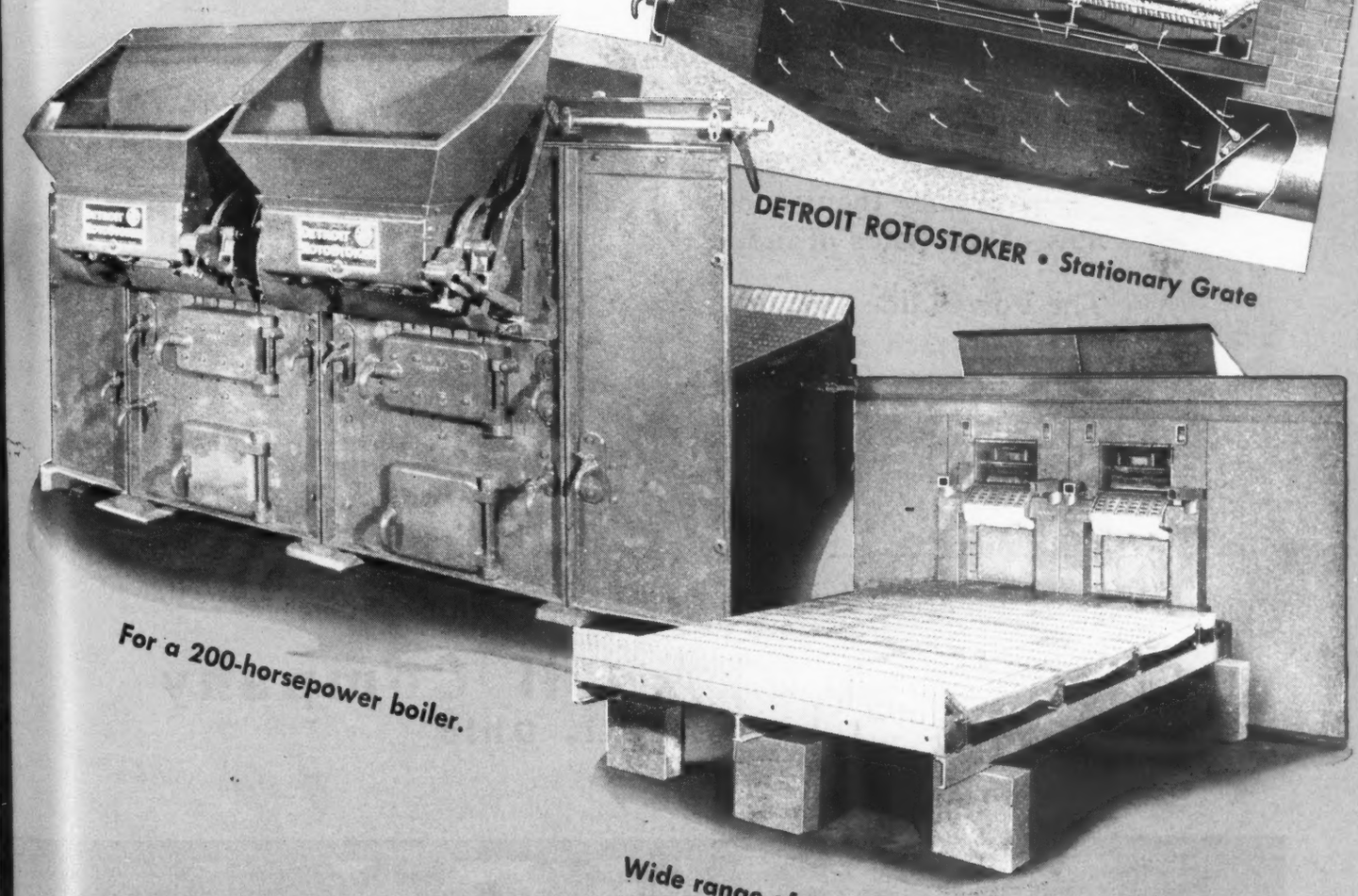
● Dumping Grates, in sections, are operated either by hand or by power cylinders. Ash is discharged below and while each section of grate is being dumped, the air supply is temporarily discontinued. The remaining sections of the Stoker continue and there is no interruption in operation, simple and effective.

When You Select a Detroit Stoker

● The Stationary Grate Type is recommended for medium boilers, if no basement is provided for ash removal. Grates are continually air cooled and protected by a thin layer of ash, so that they give long service. The unusually thin fuel bed is penetrated by many air streams or jets that produce a turbulence in the furnace, with complete burning of the fuel.



DETROIT ROTOSTOKER • Stationary Grate



For a 200-horsepower boiler.

Wide range of sizes and capacities for all boilers.

WRITE FOR BULLETIN 830

DETROIT STOKER COMPANY

Sales and Engineering Offices, General Motors Bldg., Detroit

Main Office and Works, Monroe, Mich.
Built in Canada at London, Ontario

ure.

effective.

Keep 'em Flowing

The steady, irresistible flow of American War Production is what makes it invincible. The flow of the liquids and gases that play such an important part in all modern production, to be effective, must be perfectly controlled. To keep them flowing under perfect control is our job. We have been at it just four years short of a century. During that time we have met and overcome many a problem concerned with the controlled flow of the fluids of industry.

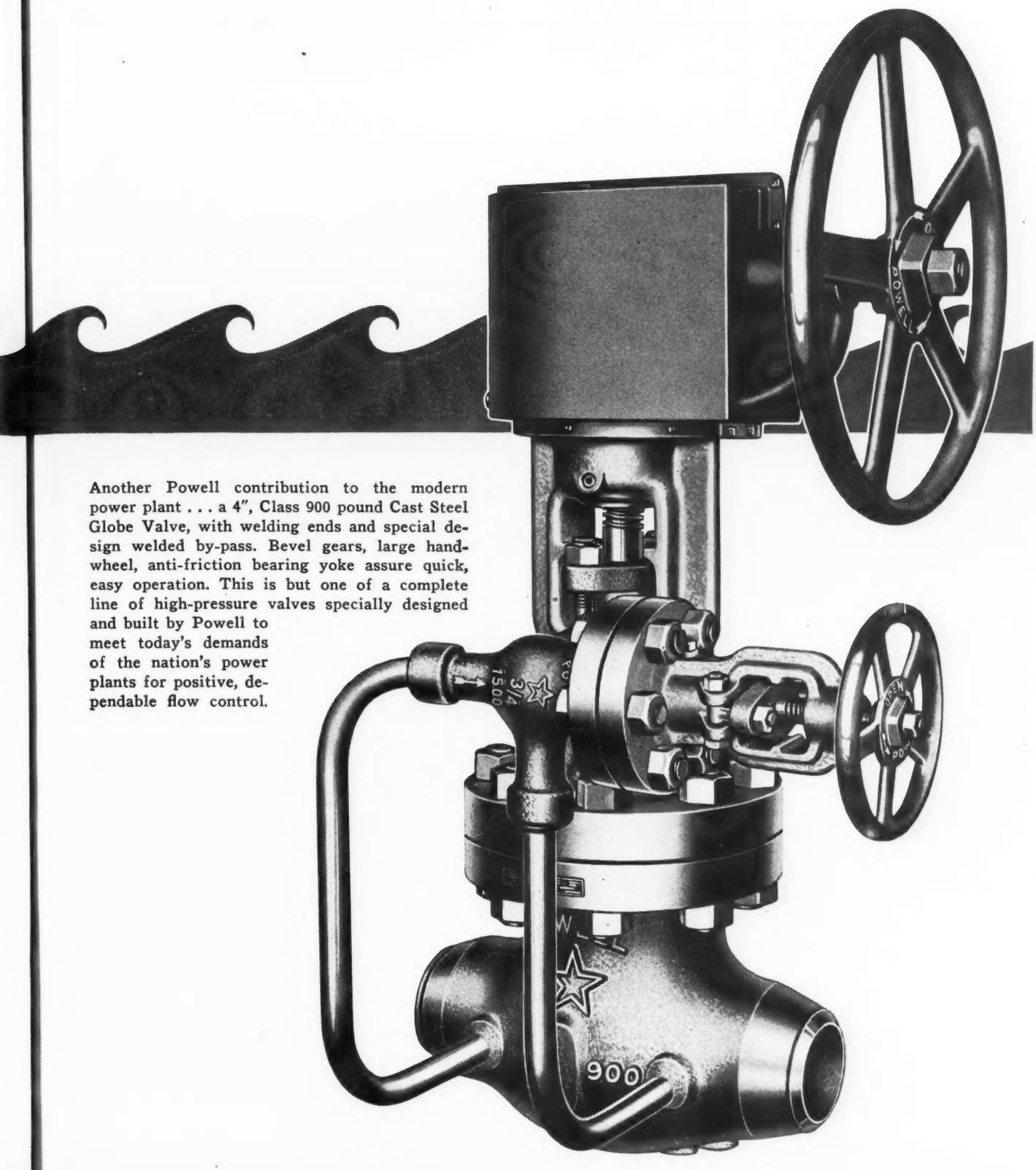
The Powell line is a collection of valves which have been built to order, each to do a special job. The Powell engineering staff, in the solution of new problems, year after year, have built up the Powell line valve by valve. Today it covers the full range of industry's needs. Tomorrow it will do the same. For industry's problems are our problems and we are ready and able to work them out. When you think of the liquids and gases of industry, and how to control them, think of Powell.

The Wm. Powell Company
Cincinnati, Ohio

POWELL

General Motors Bldg., Detroit

Built in Canada at London, Ontario



Another Powell contribution to the modern power plant . . . a 4", Class 900 pound Cast Steel Globe Valve, with welding ends and special design welded by-pass. Bevel gears, large handwheel, anti-friction bearing yoke assure quick, easy operation. This is but one of a complete line of high-pressure valves specially designed and built by Powell to meet today's demands of the nation's power plants for positive, dependable flow control.

VALVES

HOW MUCH OF YOUR

Hagan Master Sender functions instantly with slightest changes in steam header pressure. Air-operated Hagan Control assures fast, positive action, freedom from trouble in service.

Hagan Panel in eastern public utility station. Splendid results and reliable performance from original Hagan installation led to seven reorders in three stations since 1937.

POWER GOES UP IN SMOKE?

WHEN *production* counts, efficiency often tailspins, and the smoking stacks resulting sky-write a story of improper combustion, wasted fuel and power—all in an effort to get more steam.

But the price is costly.

Anything that interferes with maximum heat development in the furnace or prevents the most efficient heat absorption will lower boiler performance. Fuel-air ratio, heat absorption, air-supply control and clean heating surfaces are but a few of the factors with which alert operators are now concerned—how to increase output *without* loss of efficiency.

One means to that end—and a very effective one, too—is Hagan Automatic Combustion Control. Here is how Hagan Control can help you stretch *your* boiler capacity:

1. It produces the maximum quantity of steam from any given fuel by introducing fuel and air to the furnace in *correct* proportions for utmost efficiency.
2. It insures that the steam produced shall have *utmost* utilization value, in accordance with steam demand.
3. It insures maximum steam output from boilers of varying capacities, through *proper* distribution of load among the units in service.
4. It materially reduces soot-blowing requirements, providing *more* steam for productive work.

Other important advantages of Hagan Control under today's conditions include: reduced furnace maintenance, protection against excessive repairs to fuel burning equipment, relief from labor shortages, and increased safety of operation.

In addition, Hagan Control can be installed in a relatively short while—all that is needed in many plants to surmount peak-production hurdles.

For *more* production, and *less* sky heat, with *increased* efficiency, therefore, call in a Hagan combustion specialist . . . now!

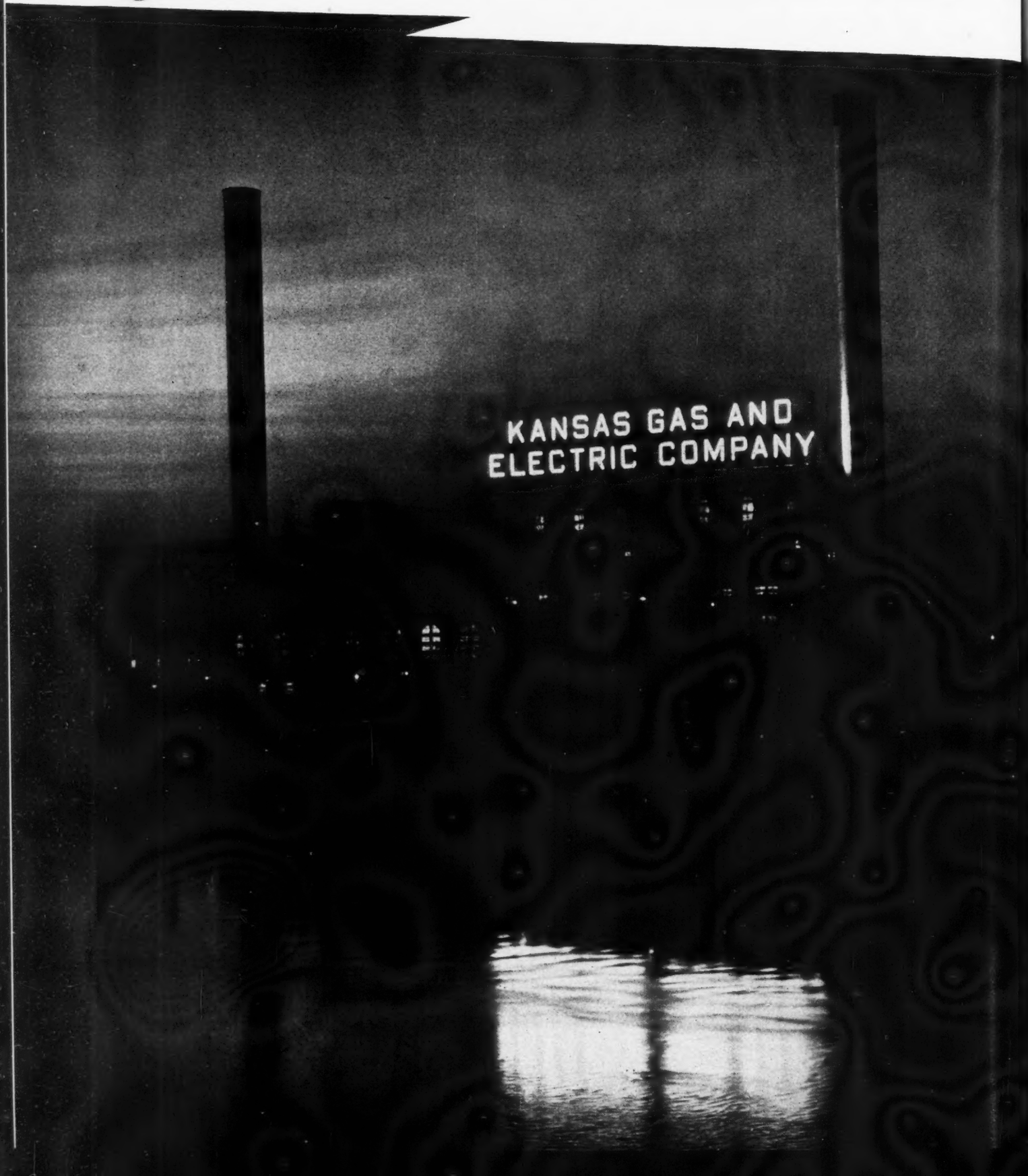
HAGAN CORPORATION
HAGAN BUILDING
PITTSBURGH, PA.

SPECIFIC ADVANTAGES OF HAGAN AUTOMATIC COMBUSTION CONTROL

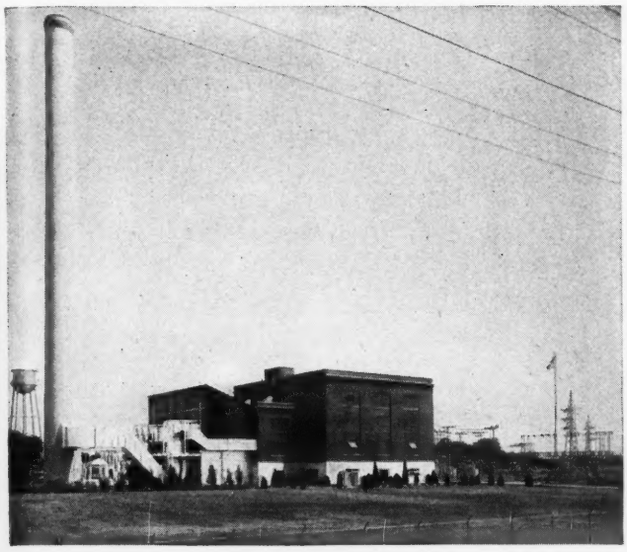
Simplicity of operation.
Ease of installation.
Ruggedness of equipment.
Sensitivity to small load changes.
Accuracy of adjustments for small variations.
Speed of movement, with stability, throughout operating range.
Flexibility in meeting individual plant conditions.
Engineered by the pioneers and leaders in automatic combustion control.

HAGAN *Automatic* COMBUSTION CONTROL
The pioneer . . . and still the leader

KILOWATTS



FOR KANSAS



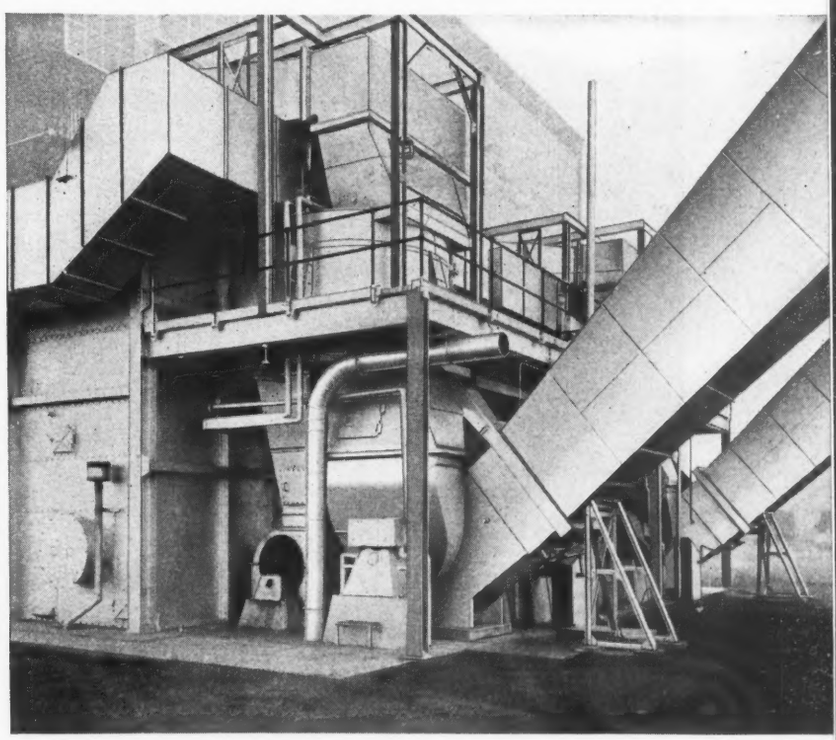
AERIAL VIEW of downtown Wichita, one of 98 municipalities served by the Kansas Gas and Electric Company. Among these are Newton, El Dorado, Pittsburg, Independence and Arkansas City. Such varied and vital products as wheat, flour, petroleum, coal, meat, cement, gas, carbide, and all-important aircraft are produced in the area served by the company.

Building Kansas with kilowatts — serving more and yet more homes, farms, commercial and industrial establishments with dependable, economical, abundant electric power—that's the job the Kansas Gas and Electric Company cut out for itself more than a quarter-century ago. The company's expansion and improvement programs have never stopped. Today, more than 253,000 persons, living in a territory of some 6,000 square miles in South Central and Southeastern Kansas, depend on the vital services of the Kansas Gas and Electric Company. In addition to the Wichita plant (at left) and new Ripley station (above), the company also has the large Neosho station at Parsons, Kansas. Installed electrical generating capacity of the great interconnected system now totals 89,000 kw. It gives us great satisfaction to have American Blower Forced and Induced Draft Fans operating as a part of these modern facilities. May we have the opportunity of discussing the advantages of American Blower Mechanical Draft equipment and Fluid Drives with you?

MECH. DRAFT · AIR-CONDITIONING
AMERICAN BLOWER
FLUID DRIVES · DUST COLLECTORS

AMERICAN BLOWER

AMERICAN BLOWER CORPORATION, DETROIT, MICH.
CANADIAN SIROCCO COMPANY, LIMITED, WINDSOR, ONTARIO
Division of American Radiator and Standard Sanitary Corporation

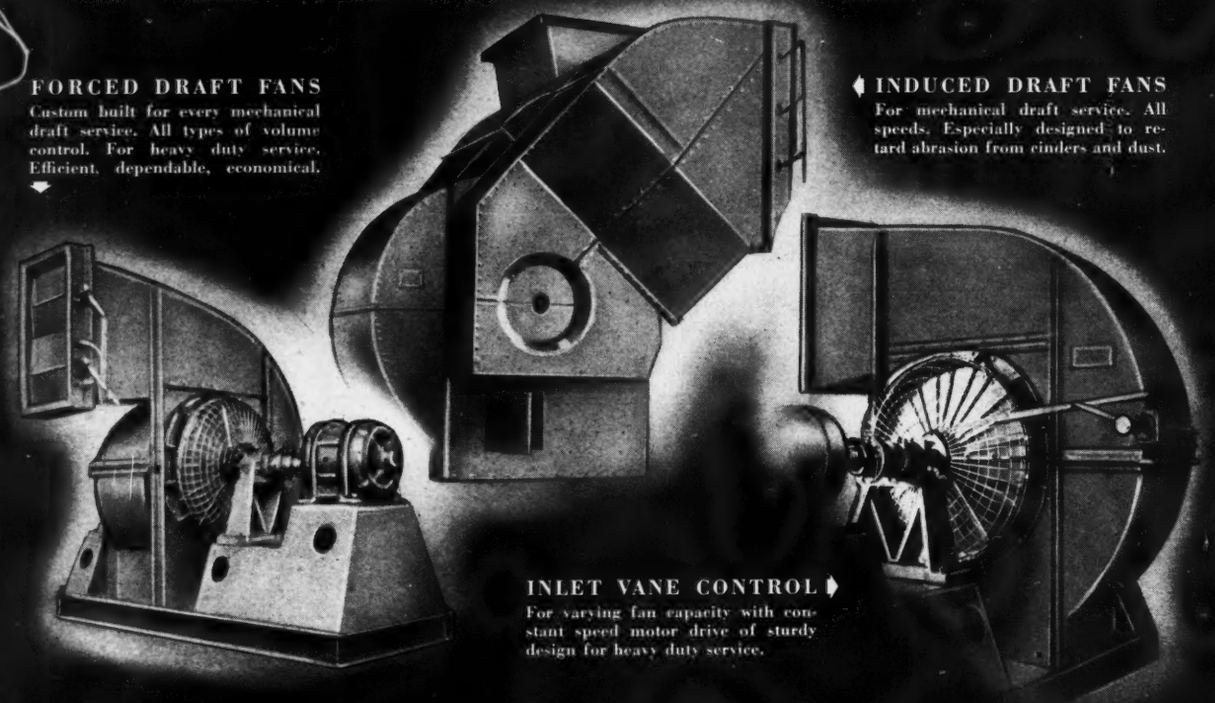


IN THE Kansas Gas and Electric Company's newest plant, the Ripley steam electric station, you'll find the dependable American Blower Forced and Induced Draft Fans shown above. Write our nearest branch for data.

FANS FOR THE "FIRING LINES" OF GOVERNMENT AND INDUSTRY

FORCED DRAFT FANS
Custom built for every mechanical draft service. All types of volume control. For heavy duty service. Efficient, dependable, economical.

INDUCED DRAFT FANS
For mechanical draft service. All speeds. Especially designed to retard abrasion from cinders and dust.



INLET VANE CONTROL
For varying fan capacity with constant speed motor drive of sturdy design for heavy duty service.

PARTIAL LIST OF RECENT INSTALLATIONS

American Locomotive Co.
American Rolling Mill Co.
Bethlehem Steel Co.
Carbide & Carbon Chemical Corp.
Carnegie-Illinois Steel Corp.
Cincinnati Milling Machine Co.
Dow Chemical Co.
E. R. Squibb & Sons
Ford Motor Co.
General Electric Co.
General Motors Corp.
Humble Oil & Refining Co.
Inland Steel Co.
Kankakee Ordnance Works
New York Navy Yard
Norfolk Navy Yard
Ohio River Ordnance Works
Oldbury Chemical Co.
Republic Steel Corp.
Texas Company
Texas Power & Light Co.
Union Electric Co. of Illinois
U. S. Naval Air Station, Pensacola, Fla.
U. S. Naval Training Station, Newport, R. I.
U. S. Naval Training Station, Great Lakes, Ill.

This partial list of recent installations of Green Forced or Induced Draft Fans tells a story—that of our activity in power plants built or modernized for the government as well as for defense industries. There is another fact, however, that we hope you will remember when you are considering the purchase of such equipment.

That fact is this . . . of these fans, many were standard in design, many special—but whether standard or special, each Green Forced or Induced Draft Fan contains *every* refinement in design and construction that only fifty years of specialized experience can build into equipment of this type.

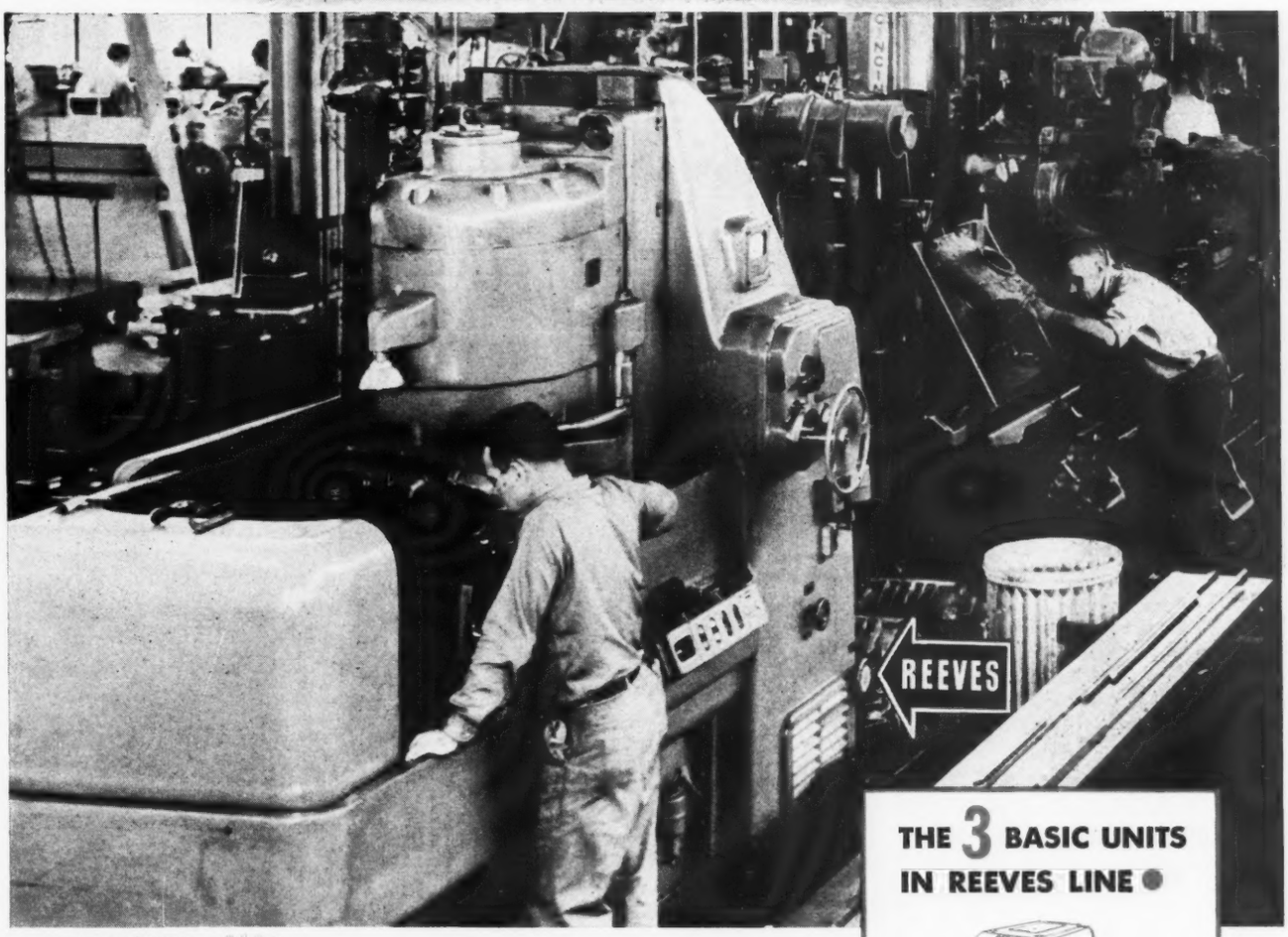
Why not consult Green—now?

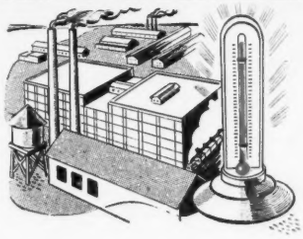
THE GREEN *Fuel Economizer* COMPANY INC.
BEACON NEW YORK

MECHANICAL DRAFT FANS · AIR PREHEATERS · ECONOMIZERS · CINDERTRAPS

6-GF-1

"The Heat is On"





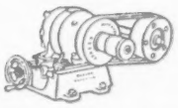
Machines equipped for accurate variable speed control get the "Production Thermometer" UP—and KEEP it up!

The magnetic chuck surface grinder pictured above is working 24 hours a day in a plant manufacturing tanks. It never has to be stopped a minute for speed changes. All the operator has to do is turn a control handwheel and the REEVES Variable Speed Transmission, installed within the frame, provides exactly the speed needed for grinding flat surface parts of all sizes up to a swing of 40 inches. With this ability to speed up and slow down as the work requires, production is faster and more accurate. Now—when the heat is on—when machines must turn out more precision work at a faster rate than ever before, REEVES-equipped machines are giving a good account of themselves. Increases of from 25 to 50 per cent in their output are not unusual.

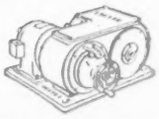
THE REEVES PULLEY CO., *Dept. A*, COLUMBUS, IND.

THE 3 BASIC UNITS IN REEVES LINE

TRANSMISSION for infinite speed control over wide range, 2:1 thru 16:1. To 87 h.p.



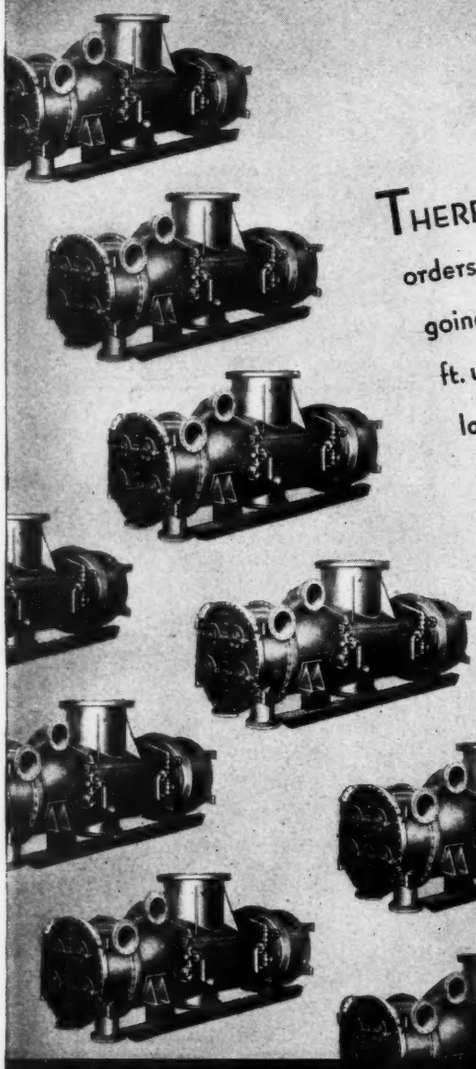
MOTOR PULLEY—simple, direct drive for fractional to 15 h.p. within 3:1 range.



MOTODRIVE combines motor, speed varying unit and reduction gears. To 10 h.p.

REEVES *Accurate Variable* Speed Control

11 More SURFACE CONDENSERS "Like All those You Built for Us Before!"



THERE can be no better tribute to the perfection of a product than repeat orders. And a group of eleven All-Welded Steel Surface Condensers now going through the Ross Plant bears this out especially • Each 3,950 sq. ft. unit is identical with the many condensers built by Ross for this same large petroleum refiner (name withheld) over a long period of years • As in the past, there is no request today for changes in design or construction. Like their predecessors, these new units are all Type "A" twin bank, balanced flow, two-pass divided water box design • Such talent for achieving completely satisfactory performance and structural details has made Ross a leader in surface condenser design since it pioneered the all-welded steel construction and many other advanced features. . . . . .

ROSS HEATER & MFG. COMPANY, Inc.

Division of AMERICAN Radiator and "Standard" Sanitary Corporation

GENERAL OFFICES AND PLANT -- BUFFALO, N. Y.

DON'T LET RUST

"PUT THE FINGER" ON YOUR TURBINES

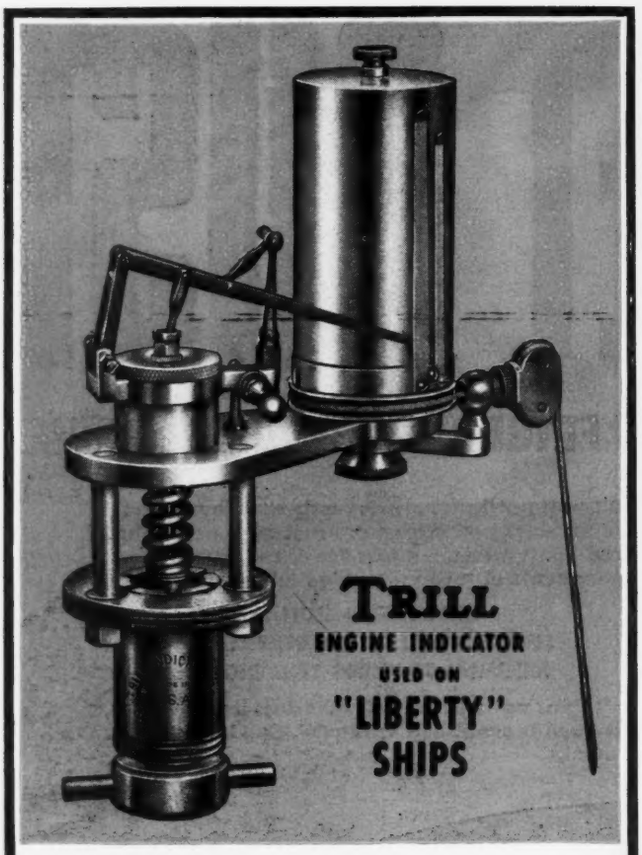
Don't wait until rust causes costly shutdowns. Refill your turbines now with new, rust-preventive Shell Turbo Oil. It meets, not just one or two, but all *three* requirements of modern turbine lubrication . . .

RUST PREVENTION
SUPERIOR OXIDATION STABILITY
MINIMUM FOAMING TENDENCY

Don't "put up" with any oil that does less. Use new, tested and proved Shell Turbo Oil. Call in Shell now for details.

SHELL

Lubricate with *New* Rust-Preventive SHELL TURBO OIL



Again . . .

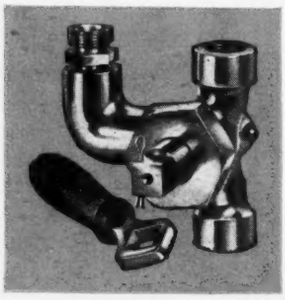
DOING ONE JOB WELL

THE Trill Outside Spring Indicator is made by an organization devoted exclusively to the manufacture of engine indicator equipment for almost fifty years. This singleness of purpose was of great value to the nation during the last war, when Trill Indicators were used on many of the ships built by the Shipping Board. It is helping again in this war. Trill Indicators and 3-Ways Cocks already have been specified for the majority of "Liberty" Ships.

In order to assure quick deliveries we have expanded our production facilities. We are now prepared not merely to do our one job well, but also to do it on a scale that matches the ever-increasing tempo of the "Liberty" ship construction program.

●

For new descriptive Bulletin T-421 write Trill Indicator Company, P. O. Box 5757, Pittsburgh, Pa.



TRILL 3-Ways Indicator Cock

TRILL INDICATOR COMPANY

PLANT AT CORRY, PA.

EXECUTIVE OFFICES AT PITTSBURGH, PA.

PUT YOUR MONEY ON THE *Heavyweight*

This year of all years, consider W-S High-Pressure, High-Temperature Forged Steel Fittings for *all* your needs—even where pressures and temperatures are only moderate. Because these fittings last far longer, you can thereby insure yourself against replacements in future months when all fittings may be far harder to get.

Service records prove that the extra endurance of these "heavyweight" fittings more than outweighs their additional cost. That's true economy and true conservation in any year.

Bulletin A-3 gives all facts on the wide available range of sizes and pressure ratings—both welding and screw-end types. Order through your regular Mill Supply Distributor.

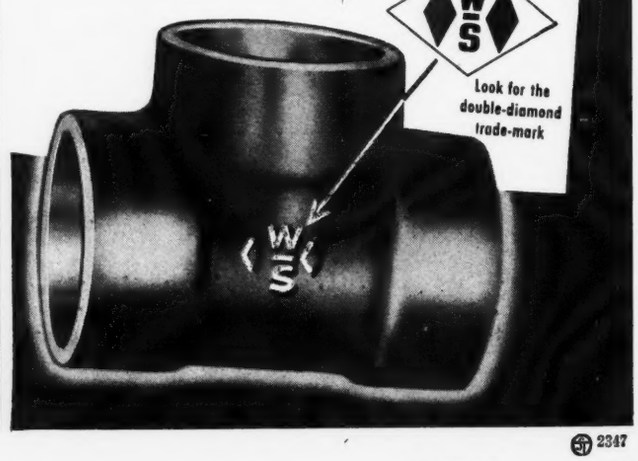
THE WATSON-STILLMAN CO.

ROSELLE, NEW JERSEY

Engineers and Manufacturers of Forged Steel Fittings and Valves, Hydraulic Machinery and Equipment—Hydraulic Presses, Pumps and Jacks

W S

Look for the double-diamond trade-mark



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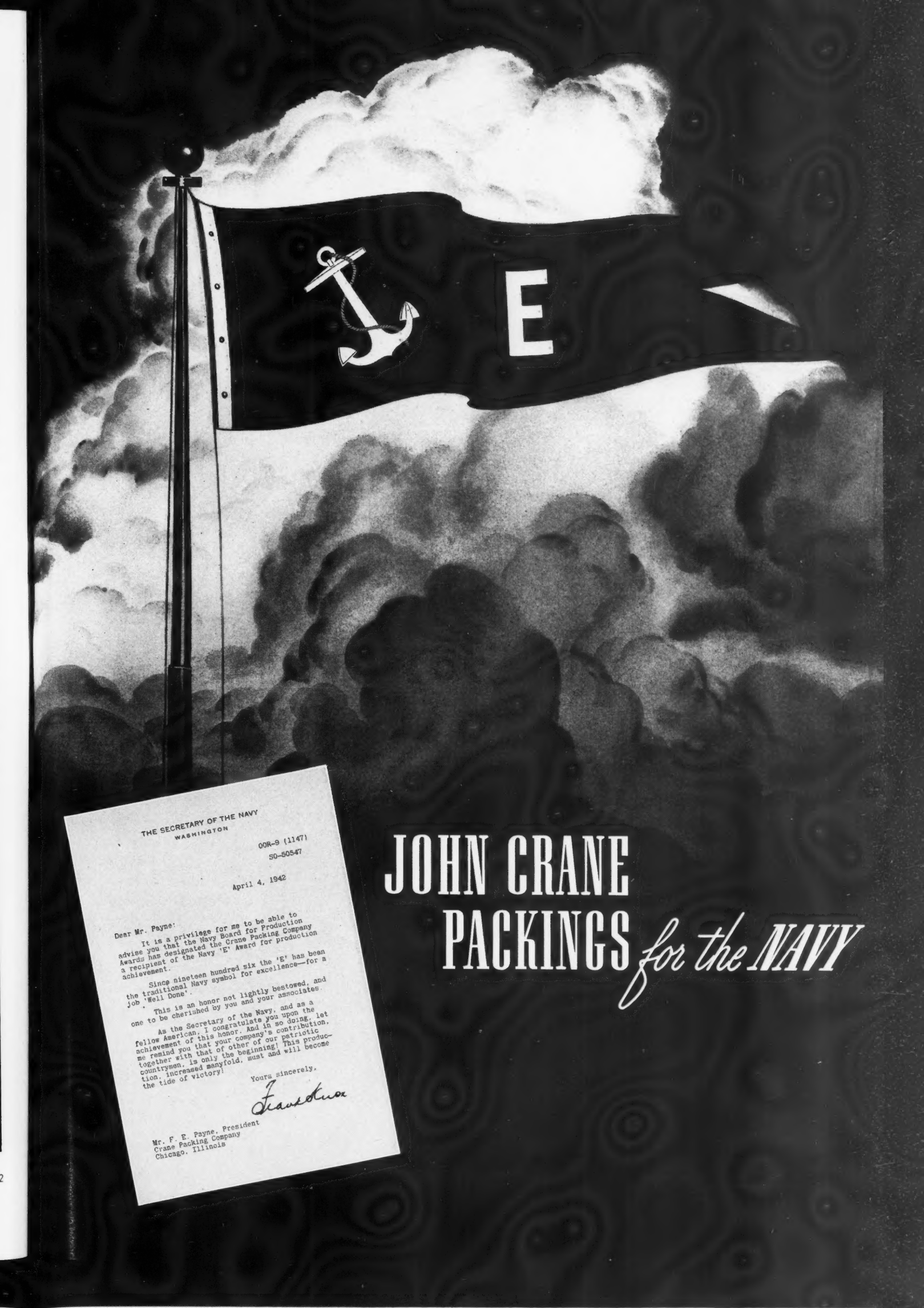


THE SECRETARY OF THE NAVY
WASHINGTON

OOR-9 (1147)
SO-50547

April 4, 1942

Dear Mr. Payne:

It is a privilege for me to be able to advise you that the Navy Board for Production Awards has designated the Crane Packing Company a recipient of the Navy 'E' Award for production achievement.

Since nineteen hundred six the 'E' has been the traditional Navy symbol for excellence—for a job 'Well Done'.

This is an honor not lightly bestowed, and one to be cherished by you and your associates.

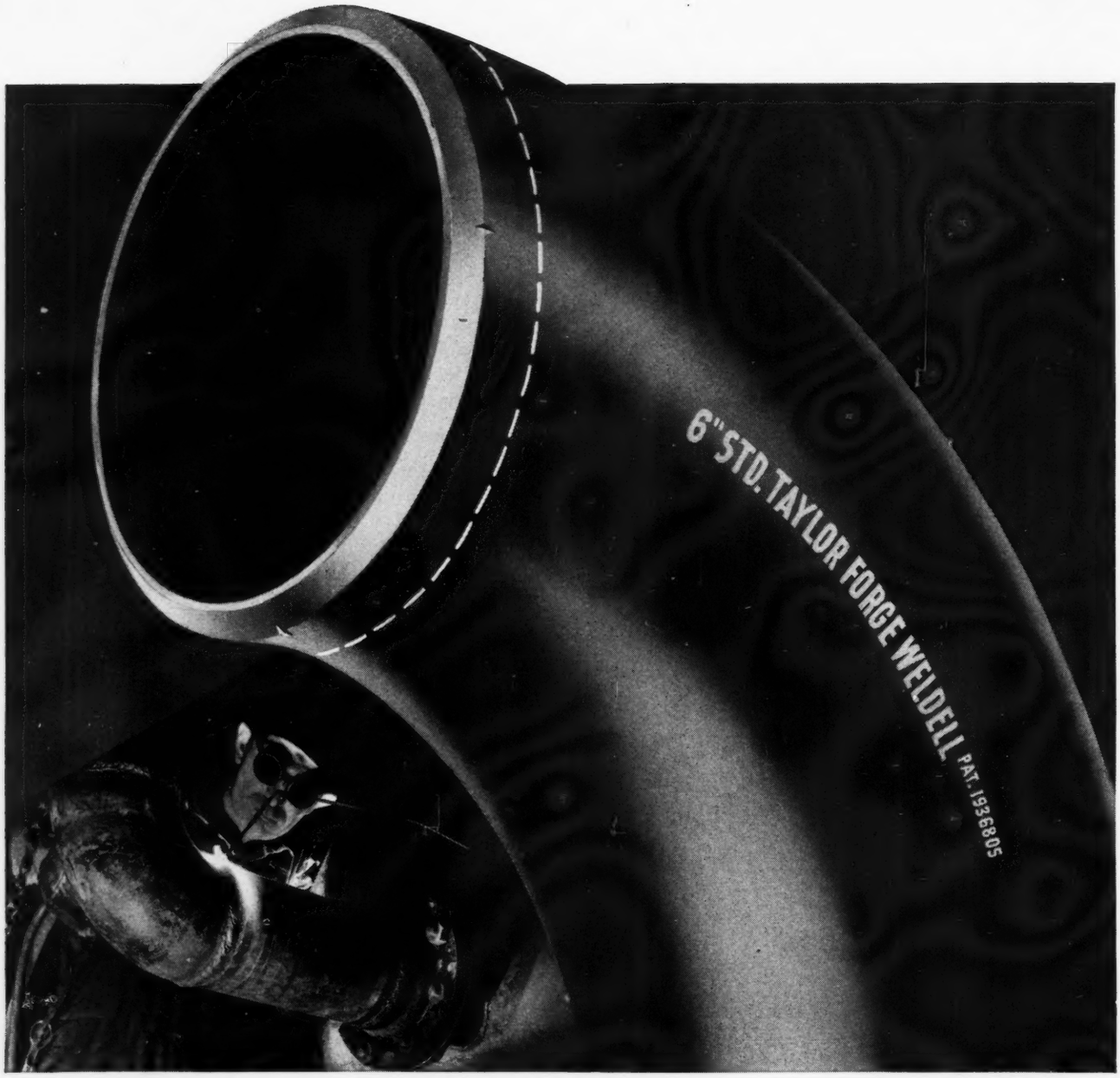
As the Secretary of the Navy, and as a fellow American, I congratulate you upon the achievement of this honor. And in so doing, let me remind you that your company's contribution, together with that of other of our patriotic countrymen, is only the beginning! This production, increased manyfold, must and will become the tide of victory!

Yours sincerely,

Frank Knox

Mr. F. E. Payne, President
Crane Packing Company
Chicago, Illinois

JOHN CRANE PACKINGS *for the NAVY*



TANGENTS rank high in the list of extra values

THOSE straight segments on each end of every WeldELL accomplish three important things: They make lining up easier; keep the weld out of the zone of greatest stress; facilitate the use of slip-on flanges.

This feature, which of course entails extra manufacturing operations, is just one of many examples of the extra-value you get in WeldELLS and other Taylor Forge Fittings for pipe welding.

A number of other extra-value features are listed opposite. Notice that each contributes something to the ease and economy of installation or to the soundness of the finished job.

These features are combined only in WeldELLS. Lacking any one of them WeldELLS could not be *"the fittings that have everything"*.

TAYLOR FORGE & PIPE WORKS, General Offices & Works: Chicago, P.O. Box 485
New York Office: 50 Church Street • Philadelphia Office: Broad Street Station Bldg.

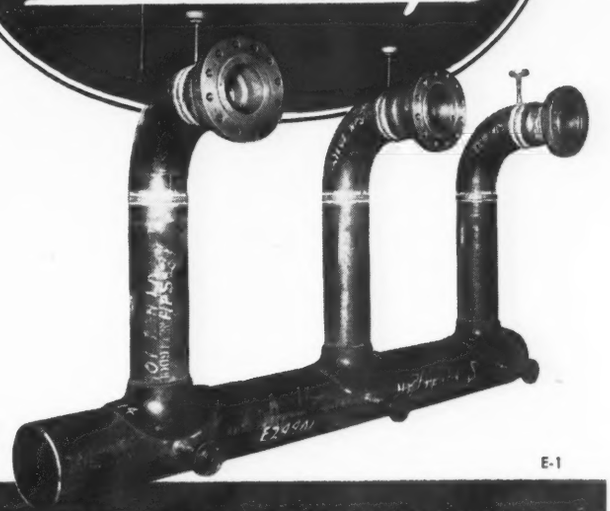
WeldELLS
have *everything*—

No other fittings for pipe welding combine these eight features. In addition to tangents these features are:

1. **Seamless**—Greater strength and uniformity.
2. **Precision quarter-marked ends**—simplify layout and help insure accuracy.
3. **Selective reinforcement**—provides uniform strength.
4. **Permanent and complete identification marking**—saves time and eliminates errors in shop and field.
5. **Wall thickness never less than specification minimum**—assures full strength and long life.
6. **Machine tool beveled ends**—provide best welding surface and accurate bevel and land.
7. **The most complete line of Welding Fittings and Forged Steel Flanges in the World**—insures complete service and undivided responsibility.

PRE-FABRICATED SHIPS SET *New* PRODUCTION RECORDS

PRE-FABRICATED PIPING HAS THE *Same Advantages*



E-1

During the First World War, 300 to 365 days were needed to build a cargo ship. Now, far better ships are completed in 105 days or less.

Pre-Fabrication is an important factor in this miracle of cutting production time by two-thirds. Ships are built in convenient sections or sub-assemblies . . . then welded together.

Pre-Fabrication has similar advantages in pressure piping. Qualified pipe fabricators can make significant reductions in the time required to complete a piping job. They have plants furnished with modern machinery and other time-saving equipment. Their workmen are highly skilled and employ production practices which save the maximum amount of time.

Pre-Fabricated Piping comes to you in a series of sub-assemblies with all difficult welding done. These sub-assemblies are commercially practical, heat treated and stress relieved when necessary, shop tested, accurately aligned, thoroughly cleaned and inspected. Erection requires a minimum of time and labor.

THE PIPE FABRICATION INSTITUTE

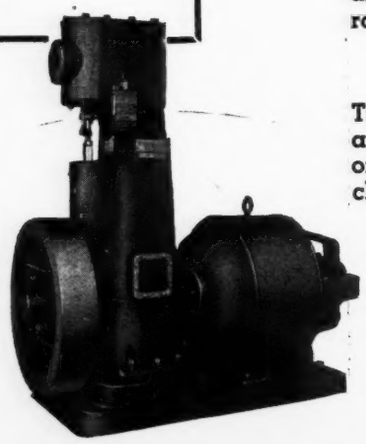
P.F.I. THE PIPE FABRICATION INSTITUTE

Devoted to the Technical and Economic Problems in Piping

1108 CLARK BUILDING · PITTSBURGH, PA.

TROY-ENGBERG

Afloat...on our bridge of Ships



Liberty Ships by the hundreds are being fitted out with Troy-Engberg Kw. Generating Sets—those modern, dependable units for delivering unfailingly the direct current so vitally needed for certain services.

Orders such as these—and there have been a succession of them—are a tribute to dependability and utility of these Sets. They're considered best for certain important engine room and bridge requirements.

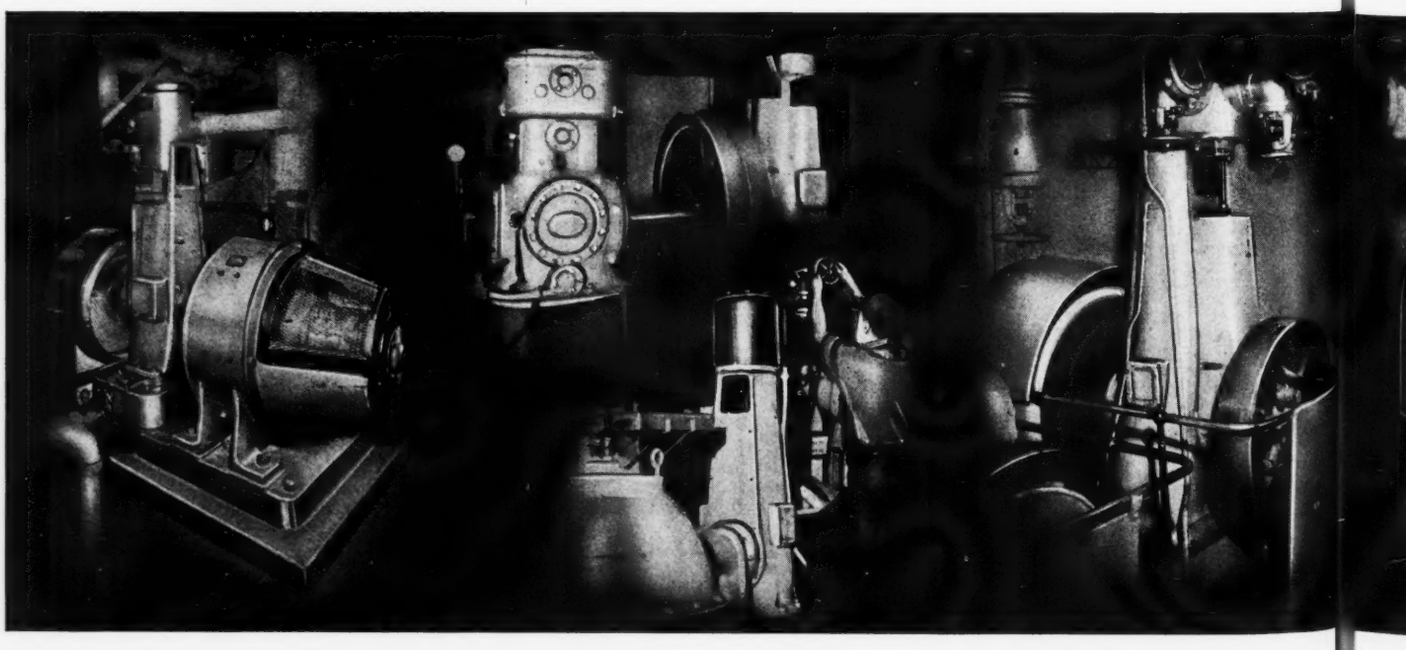
When peace again comes and ships are built for normal activities, these same Sets will still be in demand. They're too reliable and useful to be left off the specification list for any engine room.

• • •

Troy-Engberg DC and AC Sets are also widely used in industry as (1) main power for small plants; (2) auxiliary week-end, night or holiday load power for larger plants; (3) for reducing demand charges.

TROY ENGINE

Established 1870



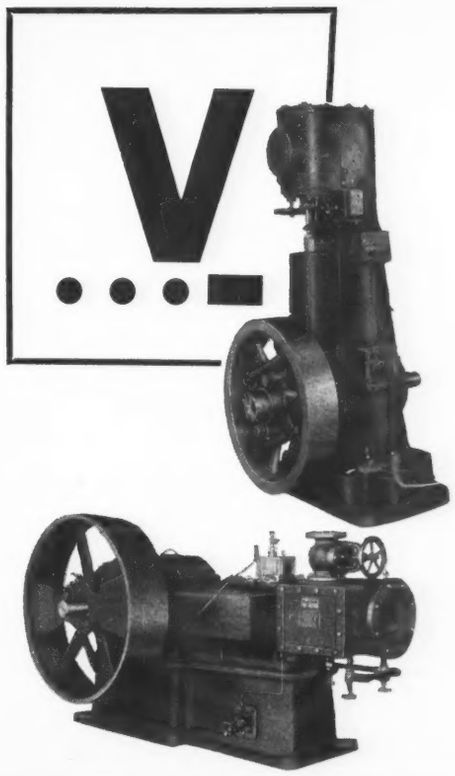
AUXILIARY POWER

Ashore...in countless Factories

Tucked in the corner of many a factory producing vitally needed equipment and supplies for the services can be found Troy-Engberg Steam Engines efficiently doing their prosaic job of driving stokers, compressors, blowers, fans, cookers, pumps, and generators.

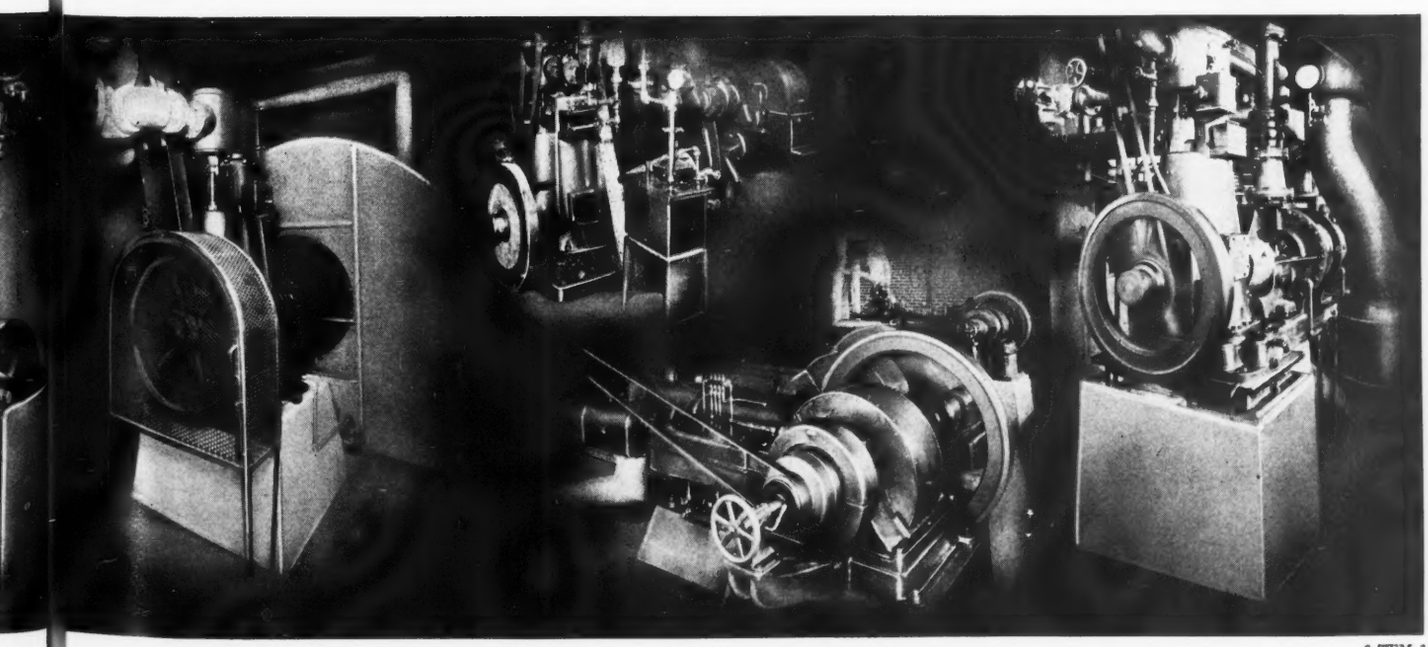
These engines have built up an enviable record of dependability and, where conditions have been suitable, an astonishing record of low-cost power. Drive characteristics, too, are exceptionally good. For some equipment no other drive can equal them.

Some day, thousands of these plants will revert to peace time activities. If yours is one, that will be the time to look over your entire power situation and see if a Troy-Engberg Steam Engine wouldn't be the best type of auxiliary drive. Remember—it furnishes both power and steam for processing or heating.



& MACHINE CO.

1479 RAILROAD AVE., TROY, PA.



6-TEM-1

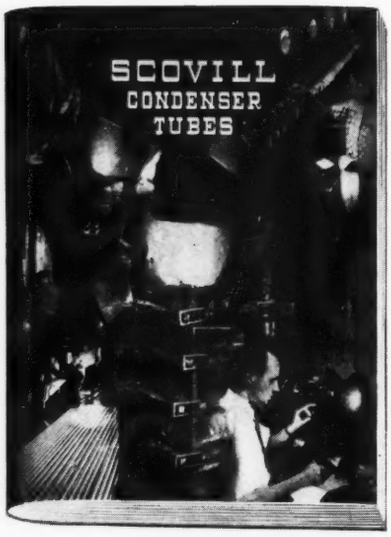
Suggestions for Prolonging Condenser Tube Service Life

Now, more than ever, condenser tube dependability and long life are factors of importance, both from the angle of uninterrupted service and the conservation of copper alloys.

In these respects, Scovill facilities will prove to be valuable to you, for Scovill offers one product—and three services.

The first service is *men*—Scovill engineers who can help you get the most out of your present tubes—then can suggest the most economical retubing alloy for your operating conditions. With a practical understanding of condenser and heat exchanger problems, these men can be of help to you on any problem pertaining to tube use. The service is free—we hope you will use it.

The second service is *manuals*. Have us send you a copy of the Condenser Tube Booklet illustrated—a source of valuable information on prolonging condenser tube service life. Write Scovill Manufacturing Company, 13 Mill Street, Waterbury, Connecticut.



The third service is *metals*. Scovill has a condenser and heat exchanger tube alloy to meet every need where a nonferrous alloy tube can be used:

MUNTZ METAL

For steam condensers and other low-temperature, low-pressure heat exchangers where raw water is fresh and low in temporary and permanent hardness and in dissolved gases (CO_2 and O_2), as, for example, many locations on the Great Lakes and a few inland rivers.

COPPER

For steam condensers where fresh water is used, and particularly with relatively soft waters carrying high concentration of dissolved gases (CO_2 and O_2); where the conditions of operation are such as to cause "dezincification" in the brasses. Copper tubes are also frequently used in heat exchangers not requiring great physical strength and where sulphur compounds and oxidizing acids are absent. Pure copper softens at approximately 200° C.

Considering the importance of economizing the use of copper for the war program, we suggest your consideration of "Phosphorized Admiralty Tubes" (with their lower copper content) for installations where copper would normally be used.

ARSENICAL COPPER

The addition of the 0.15% to 0.75% Arsenic to pure copper raises

Scovill
MANUFACTURING COMPANY
WATERBURY, CONN.

SCOVILL
one product . . .
SERVICE IN MANUALS . . .

its softening temperature so that it can be used in heat exchangers operating at temperatures up to 300° C. Hard drawn Arsenical Copper tubes have approximately the same strength as "finish annealed" Admiralty or Muntz tubes. They are usually supplied in the hard condition with ends annealed if necessary. Both laboratory tests and field service of this material indicate an improvement in corrosion resistance over previously used type of copper.

"Phosphorized Admiralty Tubes" will perform satisfactorily in most installations where Arsenical Copper is usually used. This substitution is particularly desirable now as "Phosphorized Admiralty" requires 30% less copper.

RED BRASS

For condensers and heat exchangers where it is necessary to combat "dezincification" and where acidity, if any, is of a low order. Red Brass is stronger and stiffer than copper and has excellent resistance to "dezincification" in fresh waters high in temporary and permanent hardness and in soft waters carrying high concentrations of dissolved gases (CO_2 and O_2).

"Phosphorized Admiralty Tubes" will also be a satisfactory material for these conditions. In the present tight copper situation, we suggest your use of "Phosphorized Admiralty" with its lower copper content.

ADMIRALTY

Regular

For condensers and other heat exchangers where raw water, whether fresh, brackish or saline, pure or polluted, ranges from moderately acid to alkaline. Regular Admiralty has excellent strength and ductility at temperatures up to 200° C. (390° F.) where a slight drop occurs.

"Phosphorized"*

Wherever dezincification of Regular Admiralty Tubes has been a corrosion problem, the use of Phosphorized Admiralty is suggested. This alloy combines the general excellent corrosion-resistant properties of Regular Admiralty, a desirable fine grain structure, and very marked resistance to dezincification. Several million pounds of Phosphorized Admiralty Tubes are now in service and reports of their ability to withstand both general corrosion and dezincification have been very favorable. (Priced the same as Regular Admiralty.)

ALUMINUM BRASS

In many installations where tube deterioration results from impingement (erosion-corrosion) attack, this alloy has proved superior to Admiralty. The alloy can be used with salt, brackish or fresh water at normal temperatures. The desirable corrosion-resistance properties probably result from the formation of a tough, thin, continuous film of aluminum oxide which forms on the exposed surface.

Principal uses to date and best performances have been in the marine field and tidewater plants where saline waters are encountered.

CUPRO NICKEL 70-30

Recommended for the most severe conditions in which copper alloys are serviceable. The protective film formation on this alloy is impervious, tough, and continuous. It protects against the chemical or electro-chemical action of the commonly encountered circulating media in power, petroleum, and other process plants. Erosion-corrosion resistance is of a high order.

*"Phosphorized Admiralty Tubes" for condenser and heat exchanger service are covered by patent 2,224,095 and can be legally supplied only by Scovill Manufacturing Company, the owner of this patent.

Scovill, for many years a regular source of supply for the U. S. Government, is cooperating in every way to forward defense plans. When deliveries are not as prompt as our customers desire, we hope they will realize that delays are sometimes unavoidable, and part of the price paid for National Defense.

Condenser Tubes

. . . three services

SERVICE IN METALS . . . SERVICE IN MEN

10 REASONS why you can bank on FAIRBANKS

MAKE SURE YOUR VALVES CAN'T BE REPAIRED BEFORE SCRAPPING THEM

To help conserve America's precious metals—to avoid production "holdups" from valve failure and cut valve maintenance costs to the bone—standardize on Fairbanks longer-lasting valves.

No part of Fairbanks Valves is too small to receive the same careful and exacting attention as the largest and most important part. Nothing is spared in the cost of materials and labor to make every part as perfect as possible.

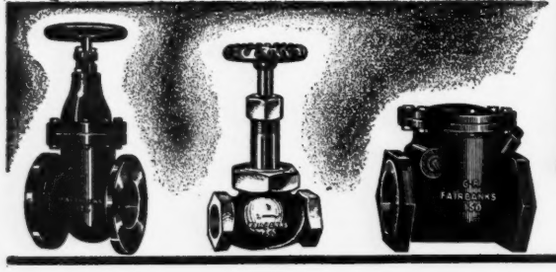
We confidently believe that a careful comparison will convince you that no other valve will give more dependable performance, lower upkeep cost or greater endurance than Fairbanks, and they sell at standard prices.

The best way to make sure that Fairbanks Valves are all we claim is to ask the Fairbanks Distributor in your territory to let you examine them. If you don't know his name we'll gladly tell you and send a copy of our catalog No. 21 on request.

1. Prompt service through conveniently located distributors.
2. Standard and Renewable types for practically every need.
3. Quality in design, materials and workmanship.
4. Uninterrupted service.
5. Low in maintenance cost.
6. Maximum years of service assured.
7. Acclaimed for dependable performance.
8. Nationally accepted by users.
9. Backed by over 50 years' specialized experience.
10. Technical assistance in valve selection.

THE FAIRBANKS COMPANY
397 Lafayette St., New York, N. Y.
Boston, Mass., Pittsburgh, Pa.

You can bank on...



FAIRBANKS

as the **RIGHT VALVES TO USE**

SHAW PREFABRICATED PIPING

THE Shaw Company's reputation for dependable, accurate, safe prefabrication and erection of piping has been built through 50 years of specialization—through meeting the exacting requirements of leading operating and consulting engineers.

Whether your piping problem is large or small, intricate or simple, high or low pressure the Shaw Company is equipped to serve you through design, prefabrication and installation. Our engineering staff is available for consultation. Write us.

BENJ. F. SHAW COMPANY

2nd & Lombard Streets, Wilmington, Delaware

PIPING FABRICATORS AND CONTRACTORS

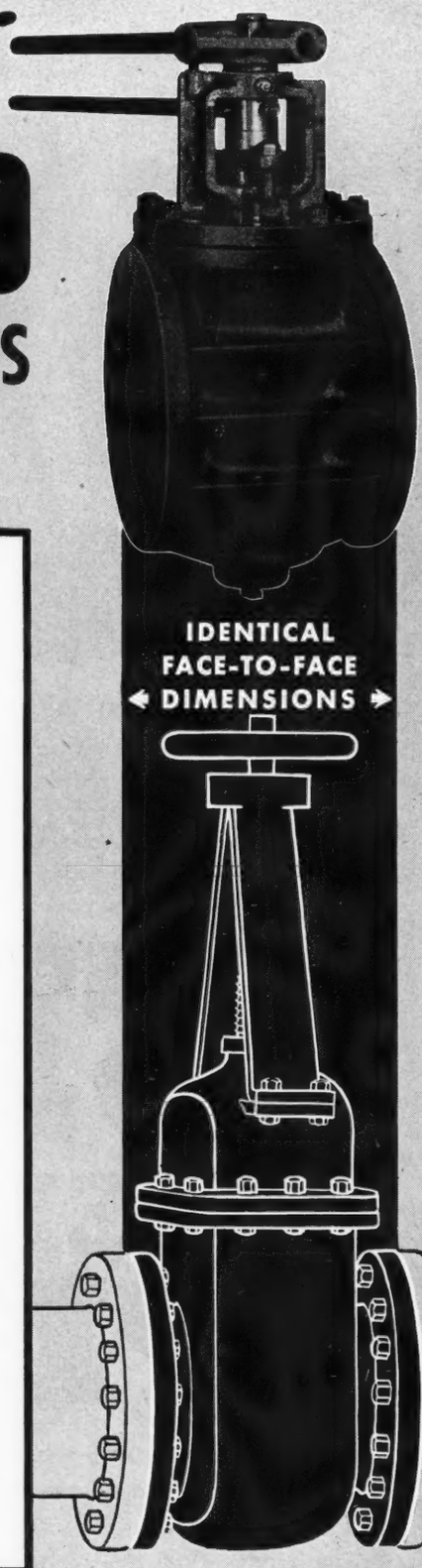
No Piping Changes

WHEN YOU USE

HOMESTEAD

LEVER-SEALD VALVES

for Replacements



Now you can have all the advantages of Homestead Lever-Seald Valves on replacements without the expense or trouble of making piping changes. Face to face dimensions of this Homestead series are identical with those of corresponding size wedge gate valves. Merely bolt the Lever-Seald Valves between flanges—and your valve troubles are over. Powerful leverage provides exceptional ease of opening and closing under the toughest service conditions. Other advantages are quarter-turn operation... protected seating surfaces... straight line flow... and a leakless seal without lubrication. Homestead Lever-Seald Valves are available for working pressures from 150 to 800 pounds—and include a choice of metals and alloys for longest service at lowest cost per year.

Write our engineering department for recommendations to meet your specific needs.

◀ *For engineering facts about these and other Homestead Valves, write for your copy of Valve Reference Book No. 38.*

MAKERS OF "PEAK PERFORMANCE" VALVES FOR 50 Years 1892 1942

HOMESTEAD VALVE MFG. CO.

P. O. BOX 210 • • • CORAOPOLIS • • • PENNSYLVANIA

Gentlemen!

THE STORY
IN ONE PAGE

THERE'S NO MAGIC IN IT
NO MYSTERY ABOUT IT

"PHOSCALOID"

A patented and universally used Protein Acid Phosphate and highly concentrated liquid with 43% P_2O_5 including 13% selected Colloids. Its advantages over the Soda Acid Phosphates in treating boiler feed waters are established facts. As an after treatment for lime-soda softening plants it is not only most effective in destroying the remaining hardness, but costs approximately 50% less per 1,000 gallons. Here again this type of organic conditioning is proving one of the best possible assurances against feed line and pump deposits. For direct treatment against hard sludge and Silica depositions, it also requires on an average of 25% less volume to produce even better results, than with the usual Soda Phosphates—all due, of course, to the reactive effects of protein on calcium.

Just a matter of using a
PROTEIN ACID PHOPHATE
instead of the usual
Soda Acid Phosphates for
CLEANER SAFER BOILERS

A booklet "Silica vs. Phoscaloid" describes the early development of feed water treatments and outlines the logic behind the success of Phoscaloid. A free copy will be mailed at your request.

CYRUS WM. RICE & COMPANY, INC.

PITTSBURGH PENNSYLVANIA

GLASS BOMBS FOR VICTORY

STEEL SAVED IN AMERICA IS STEEL SAVED FOR EQUIPMENT ON THE FIGHTING FRONTS . . .

THE great need for huge plants to house essential machinery and equipment to carry on our war effort, and the scarcity of materials from which they can be constructed, constitute an increasingly serious problem. Architects and engineers, always conscious of available materials for a given requirement, now must function on an even higher plane of selectivity, utilizing alternates more extensively.

Almost the entire supply of some very basic materials must be melted and molded into implements of war. The extent to which less critical materials are utilized will have a definite bearing upon the time required to bring the war to a successful conclusion.

Time, the essence of vast production under any circumstance, is infinitely important to the nation today . . . for lives will be saved or lost in almost direct ratio to the time required to equip our men with ammunition, armament and planes.

In the construction emergency created by war, Owens-Illinois is happy to be in a position to serve with its Insulux Glass Block.

Insulux' uses are many and varied . . . for large areas in new buildings, which supplant substantial quantities of critical materials . . . for maintenance, so essential to continued service under severe production pressure . . . for repairs and rehabilitation within the scope of government regulations.

Glass ingredients, fortunately are native and still available. Glass in the form of Insulux blocks, minimizes the use of critical materials to a high degree—while bringing to building, possibilities for speedy erection along with insulation and light control.

Send us your inquiries. We promise the very best that's in us for the solution of construction problems which confront you under these war conditions.

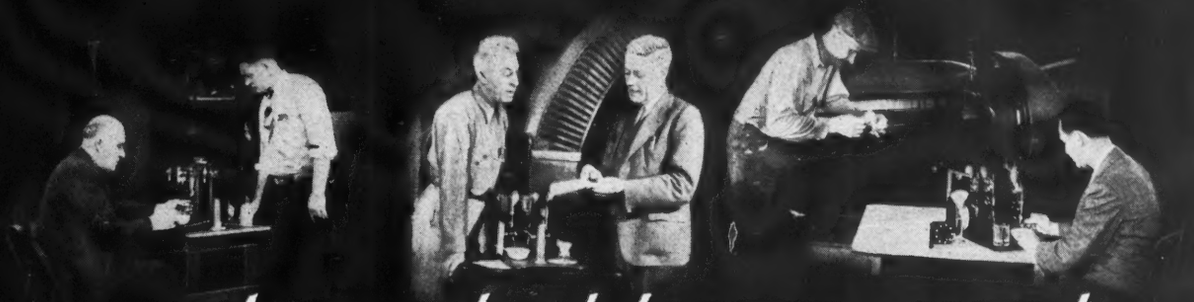
INSULUX PRODUCTS DIVISION

OWENS-ILLINOIS GLASS COMPANY

TOLEDO

TO SUPPLEMENT

a personalized field service



and scientific laboratory control

we now offer a new and complete line of

BIRD-ARCHER WATER TREATMENT

WATER TESTING EQUIPMENT
CONDUCTIVITY APPARATUS
PROPORTIONING PUMPS
CHEMICAL FEEDERS

Send for your copy of this new catalog

. . . the *complete* system of industrial feed water purification

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Scientific Boiler Water Treatments
SINCE 1885

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EFFICIENT LUBRICATION DEMANDS *Continuous* DE LAVAL PURIFICATION

THE basic requirement for efficient purification of lubricating oil is that the process must *continuously* remove the harmful impurities from the oil and so *continuously* maintain it in condition to lubricate most effectively. Such purification reduces engine or turbine wear, improves reliability, lowers repair and maintenance costs, makes available more operating hours per year and, finally, lowers lubricating cost. Any occasional treatment of oil cannot accomplish all these results.

For nearly a quarter century De Laval Oil Purifiers have achieved such results by the effective utilization of centrifugal force, removing harmful impurities from the oil rapidly and surely.

De Laval Oil Purifiers are available as complete, compact, fully enclosed plants such as the "Uni-Matic" which includes pumps, heaters where required, gauges, sampling cocks and other conveniences for purifying the oil. Bowls or purifying members are scientifically rated as to efficiency and capacity.

Why not write today for further details?

THE DE LAVAL SEPARATOR COMPANY
165 Broadway, New York 427 Randolph St., Chicago
DE LAVAL PACIFIC CO., 61 Beale St., San Francisco
THE DE LAVAL COMPANY, Limited
Montreal Peterborough Winnipeg Vancouver

DE LAVAL *OIL PURIFIERS*

They rarely need attention... BUT they deserve it now!

Very rarely does your adding machine or your Sloan Flush Valve need attention. But both are mechanical instruments and so, both *will* wear. That being the case (if you couldn't get another) you would be careful to take care of the one you have.

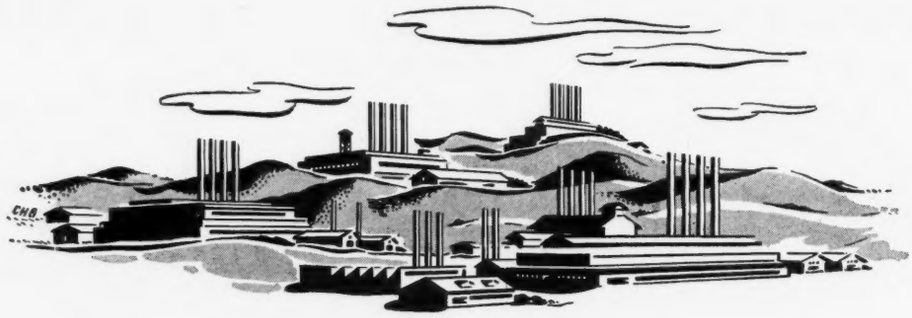
Take care of your Sloan Flush Valves. Every material entering into their manufacture is on the critical list. Conserve vital metals by proper maintenance.

Call in your master plumber today and have him check over your Sloan Flush Valves. Such a check-up will result in two things: (a) put the valves that *do* need attention in A-1 condition, and (b) give you the assurance that your Sloan Flush Valves are as good as new—ready for more years of trouble-free, water-saving service under all conditions.

SLOAN VALVE COMPANY

4300 West Lake Street • Chicago

SLOAN FLUSH VALVES



40,000 TODD UNITS helping to cook Hitler's goose!

DEFEAT of the Axis begins in America's power plants, where fuel-energy is unleashed and put to work... is transformed into machines turning . . . planes flying . . . shells blasting the enemy's strongholds! All-out power production . . . top combustion efficiency . . . mean more tools for the job . . . speedier overthrow of Berlin, Rome and Tokio!

Todd equipment, in power plants of every type, is taking today's three-shift load in its stride . . . setting the pace everywhere for minimum-maintenance and maximum-performance in the firing of liquid and gaseous fuels. Over 40,000 Todd units are now in service, in individually designed installations, backed by more than a quarter-century of combustion engineering experience. Todd technical service staffs in key cities, with parts and replacements always available, are helping industry to reach—and surpass—the power-quotas required by America-at-war.

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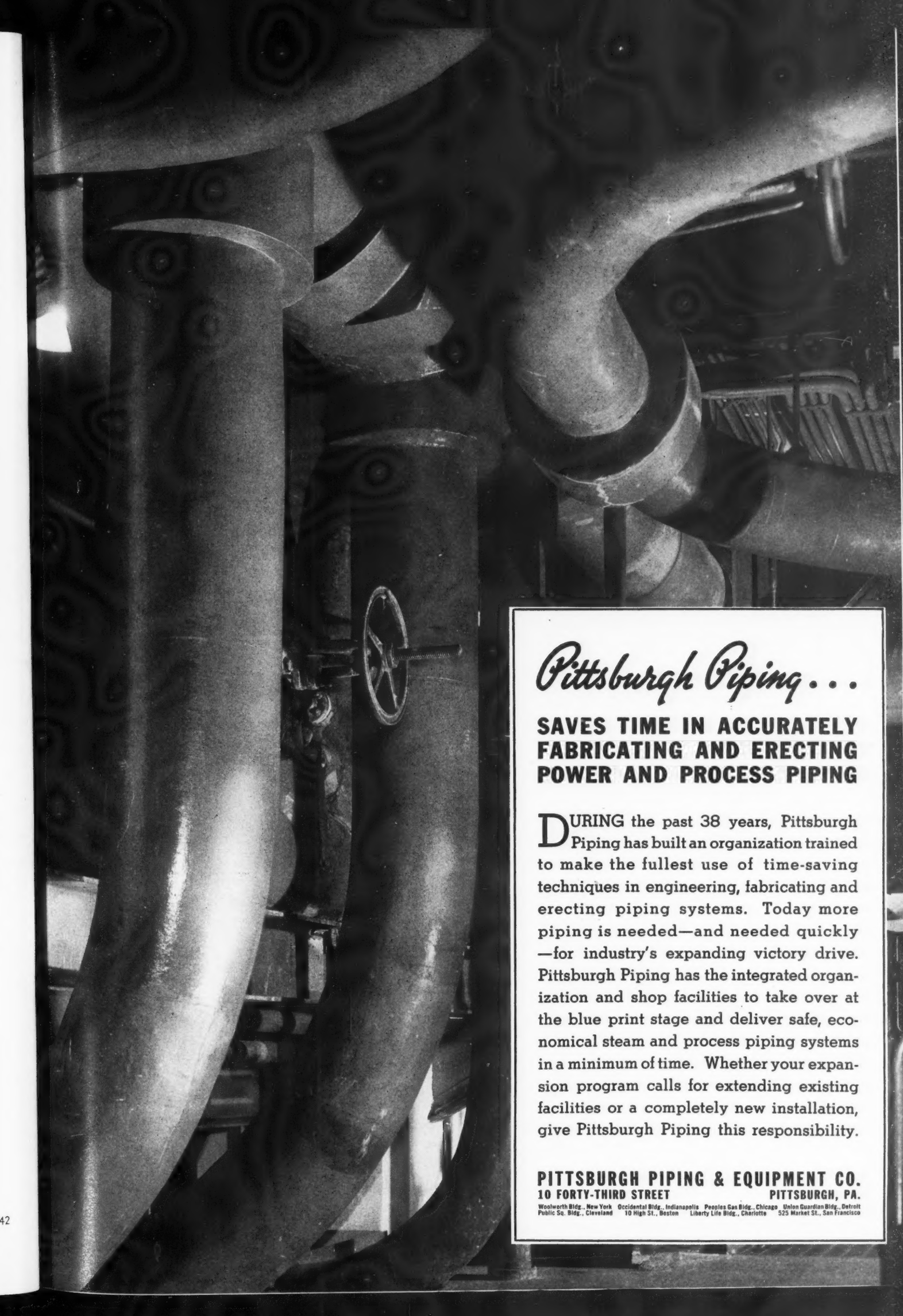
NEW YORK MOBILE NEW ORLEANS GALVESTON SEATTLE BUENOS AIRES LONDON



Pittsburgh Piping . . .

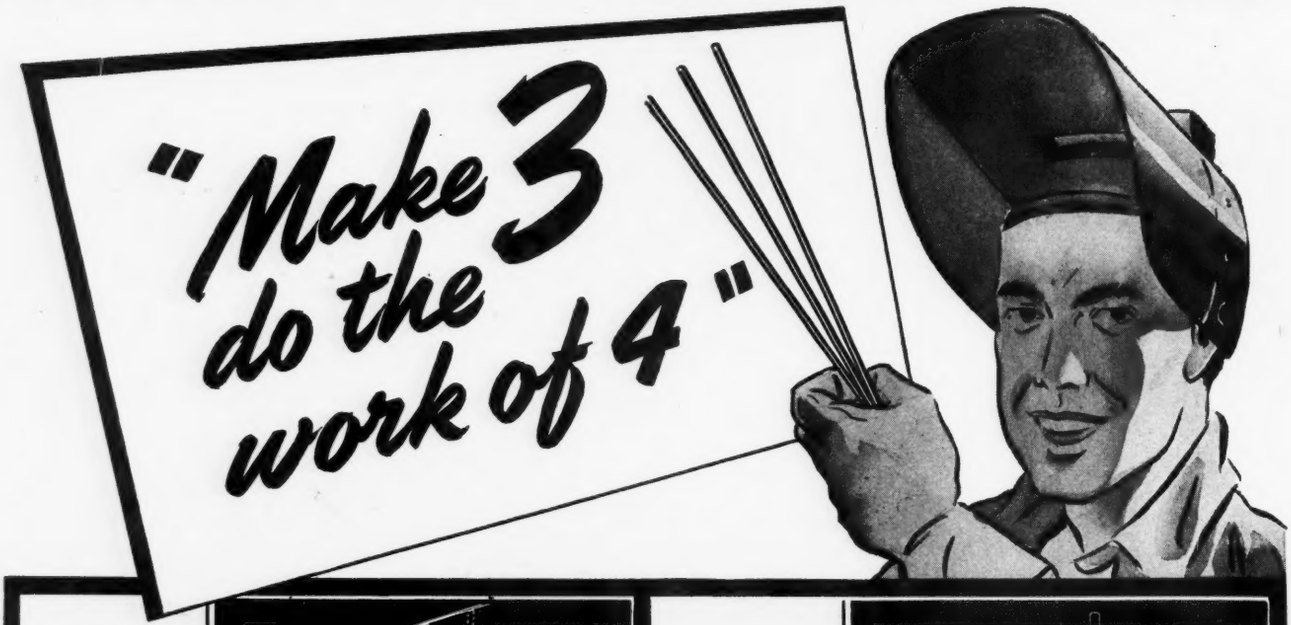
SAVES TIME IN ACCURATELY FABRICATING AND ERECTING POWER AND PROCESS PIPING

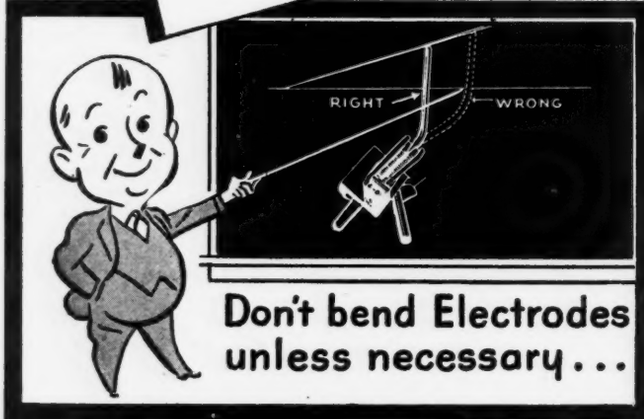
DURING the past 38 years, Pittsburgh Piping has built an organization trained to make the fullest use of time-saving techniques in engineering, fabricating and erecting piping systems. Today more piping is needed—and needed quickly—for industry's expanding victory drive. Pittsburgh Piping has the integrated organization and shop facilities to take over at the blue print stage and deliver safe, economical steam and process piping systems in a minimum of time. Whether your expansion program calls for extending existing facilities or a completely new installation, give Pittsburgh Piping this responsibility.

PITTSBURGH PIPING & EQUIPMENT CO.
10 FORTY-THIRD STREET PITTSBURGH, PA.

Woolworth Bldg., New York · Occidental Bldg., Indianapolis · Peoples Gas Bldg., Chicago · Union Guardian Bldg., Detroit
Public Sq. Bldg., Cleveland · 10 High St., Boston · Liberty Life Bldg., Charlotte · 525 Market St., San Francisco

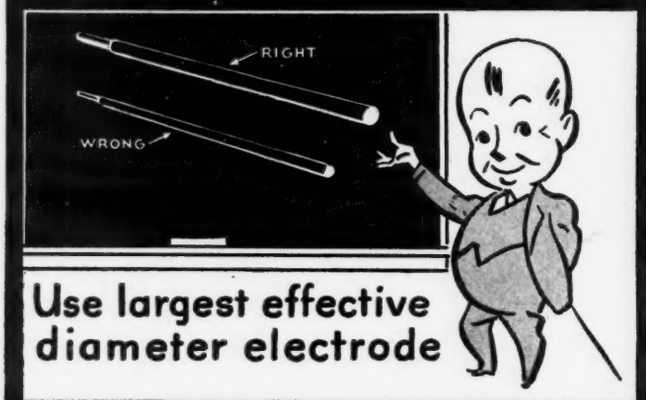
WELDING ELECTRODES ARE SCARCE



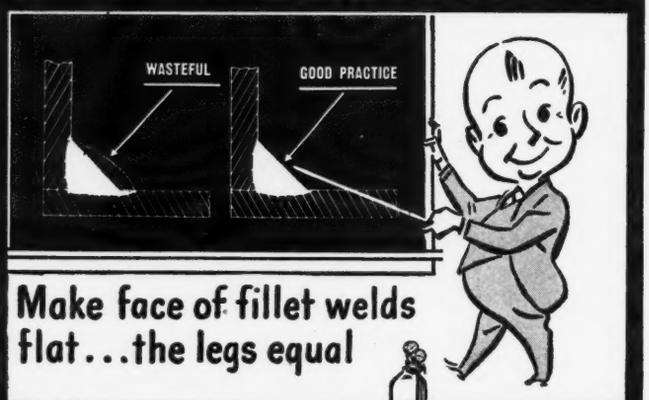


Don't bend Electrodes unless necessary...

Dont leave more than 2" Stub...



Use largest effective diameter electrode



Make face of fillet welds flat...the legs equal

A booklet of shop bulletins illustrating "'do's' and 'don'ts'" has been prepared. We'll gladly send you as many copies as you can use.

We can all prevent waste of valuable welding electrodes by following these and other simple, common sense suggestions. 25% to 30% more welding can, and must, be obtained from available electrodes.

AIR REDUCTION

60 EAST 42nd STREET, NEW YORK, N.Y.

In Texas: Magnolia-Airco Gas Products Co.

IDLE CYLINDERS ARE PRODUCTION SLACKERS: KEEP 'EM ROLLING FOR VICTORY!

Power lost in transit means LOST PRODUCTION

Enlist MORSE CHAIN DRIVES TO Convoy

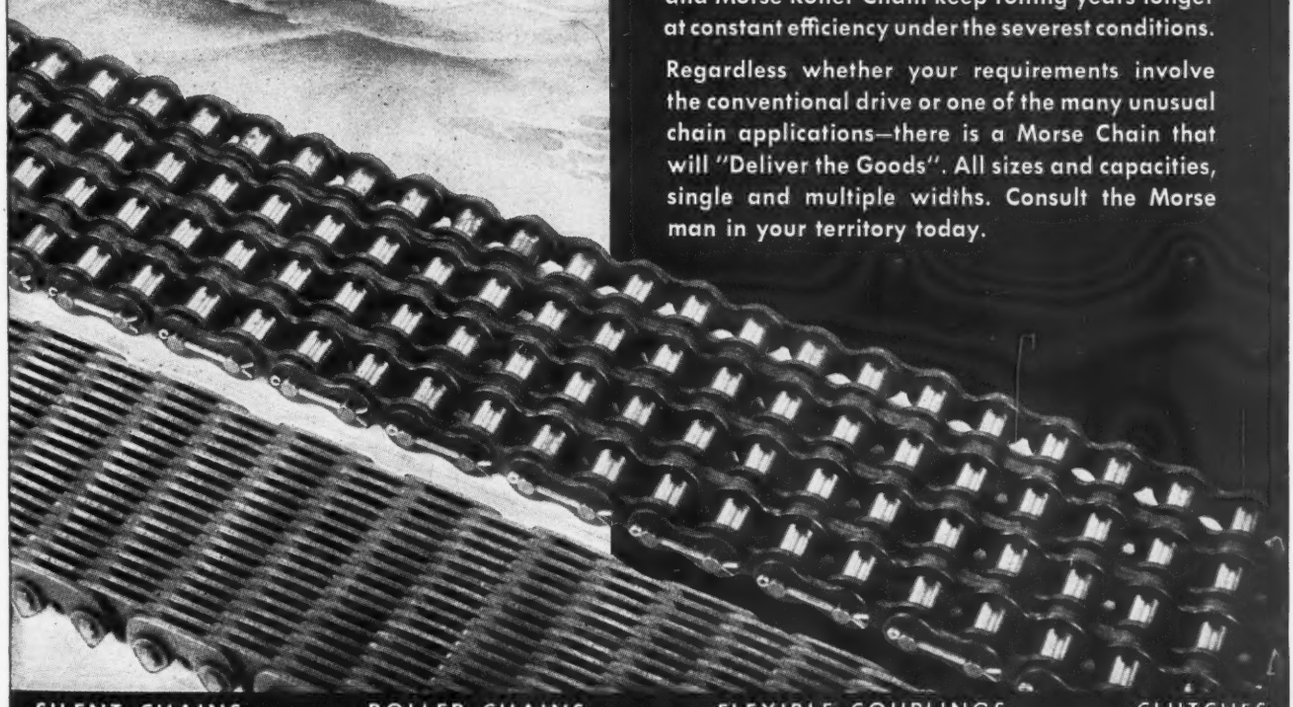
Vital Machine Power Without SLIPPAGE OR WASTE

Like ocean convoys, power in transit needs protection too . . . it faces many hazards of the elements, over-loads, shocks—which if not properly protected against with efficient drives will result in slip, power waste, and lost production.

Don't take chances. Make sure every drive in your plant delivers maximum production capacity with Morse Silent and Roller Chain Drives—no slip—no power waste.

The exclusive "Rocker Joint" Morse Silent Chain and Morse Roller Chain keep rolling years longer at constant efficiency under the severest conditions.

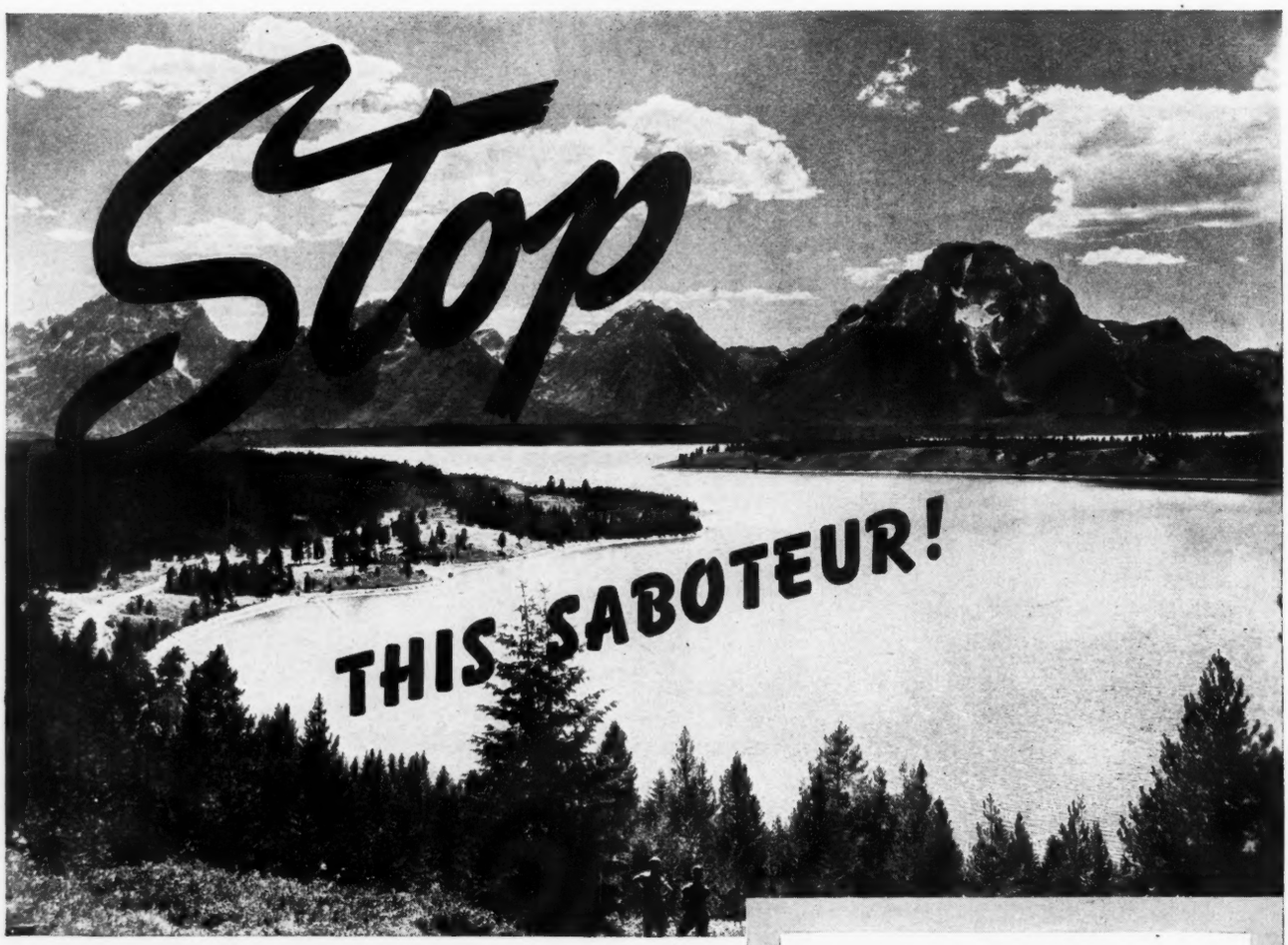
Regardless whether your requirements involve the conventional drive or one of the many unusual chain applications—there is a Morse Chain that will "Deliver the Goods". All sizes and capacities, single and multiple widths. Consult the Morse man in your territory today.



SILENT CHAINS ROLLER CHAINS FLEXIBLE COUPLINGS CLUTCHES

MORSE positive DRIVES

MORSE CHAIN COMPANY ITHACA N. Y. DIVISION BORG-WARNER CORP.



Guards at every gate may protect your plant from human saboteurs. But what protection are you providing against other saboteurs . . . who enter your plant unchallenged through the water mains?

The innocent appearance of water may be a perfect disguise for saboteurs which can slowly, but surely, destroy vital parts of your power plant. Unless properly conditioned against scale, corrosion embrittlement, carry-over, etc., water can be as damaging to vital production as a bombing!

Infilco Equipment for boiler and evaporator feedwater treatment, cooling water conditioning, condensate oil removal, steam purification, etc. is engineered and built to the specific requirements of your plant by an organization of 48 years experience. Our complete facilities are at your service.

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325 W. 25TH PLACE, CHICAGO, ILL.
Formerly **INTERNATIONAL FILTER CO.**

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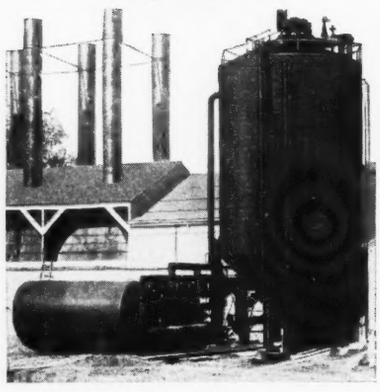


HOT-FLOW WATER SOFTENERS

The preferred method of modern boiler feed water treatment. Heats and treats make-up, heats condensate returns and deaerates both when deaeration is required. Send for Bulletin 1850.

INFILCO

ACCELATOR SOFTENERS • CATEXERS
CHEMICAL FEEDERS • CLARIFIERS • COOLING WATER CONDITIONERS
CONDENSATE FILTERS • HOT-FLOW SOFTENERS • LIME-SODA SOFTENERS
PROPORTIONERS • STEAM PURIFIERS • WATER FILTERS • ZEOLITE SOFTENERS

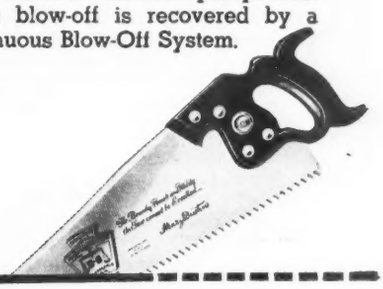
DISSTON meets tough feedwater problem with COCHRANE Deaerating Softener

New boiler house of Henry Disston & Sons, Inc., H. M. Wilson Co., Engineers & Constructors, Philadelphia.

View showing, above, the oil removal filter and two Cochrane-treated Water Filters and Sedimentation Tank of Cochrane Deaerating Hot Process Softener. Laboratory table in foreground.

AT the plant of Henry Disston & Sons, Inc., in Philadelphia, the normal power needs of this century-old manufacturer of saws, tools, files, knives and steel, plus the enormous defense load it has recently taken on, are amply provided for in the new high-pressure boiler plant just completed, in which a Cochrane Deaerating Softener and a Cochrane Continuous Blow-Off System are a part of the ultra-modern equipment.

The raw boiler water is river water with a hardness of 40 to 50 parts per million. It enters the softener at 60°F. from the heat exchanger of the Cochrane Continuous Blow-Off System and is treated with phosphate, the feeding of which is automatically controlled by a Cochrane Flow Meter. The treated make-up is deaerated by atomization in the softener. Condensate, after passing through a Cochrane Oil Removal Filter, is deaerated separately in the softener and joins the treated raw water at the feed pump. Heat from the boiler blow-off is recovered by a Cochrane Continuous Blow-Off System.



★ Many unique applications of feedwater treatment together with a discussion of Boiler Feedwater Analyses and Their Interpretation are included in Cochrane's handbook on Hot Process Softening, a copy of which will be mailed on receipt of coupon below.

COCHRANE CORPORATION • 3106 N. 17th ST., PHILADELPHIA, PA.

Cochrane

SOFTENERS • DEAERATORS • FLOW METERS • STEAM SPECIALTIES

Cochrane Corporation
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Please send me a copy of Cochrane Publication 3106 (Hot Process Softening).

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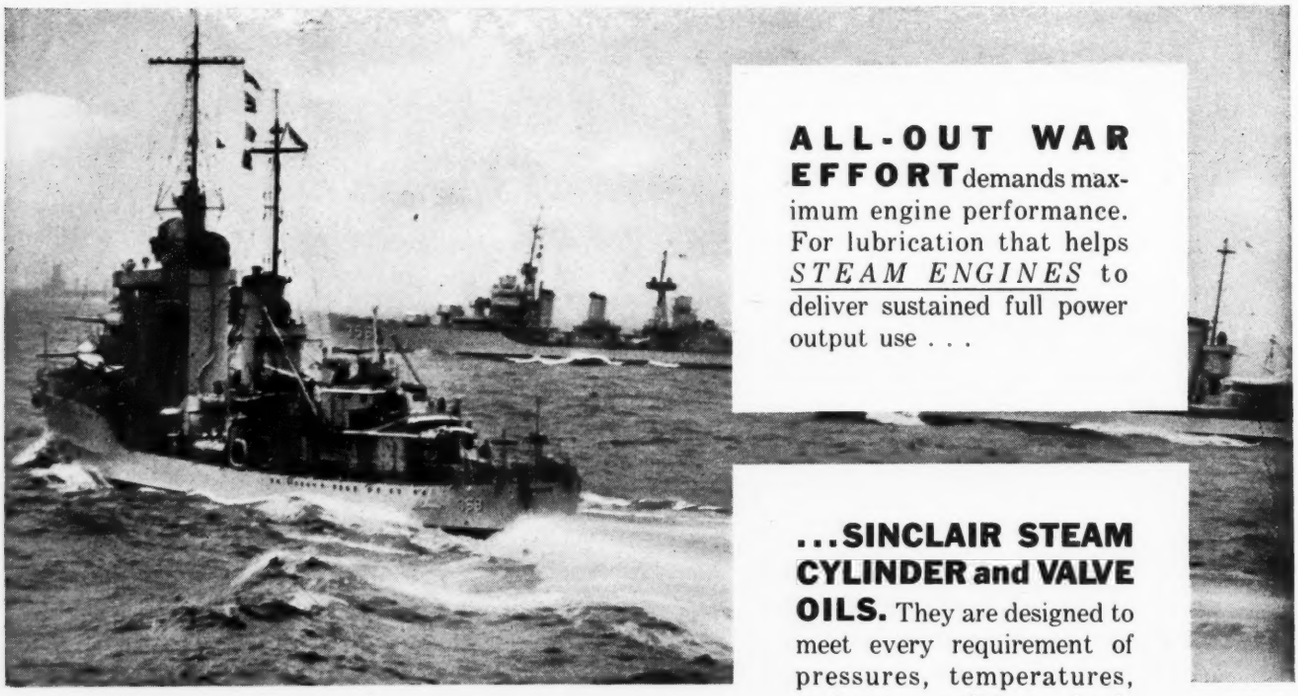
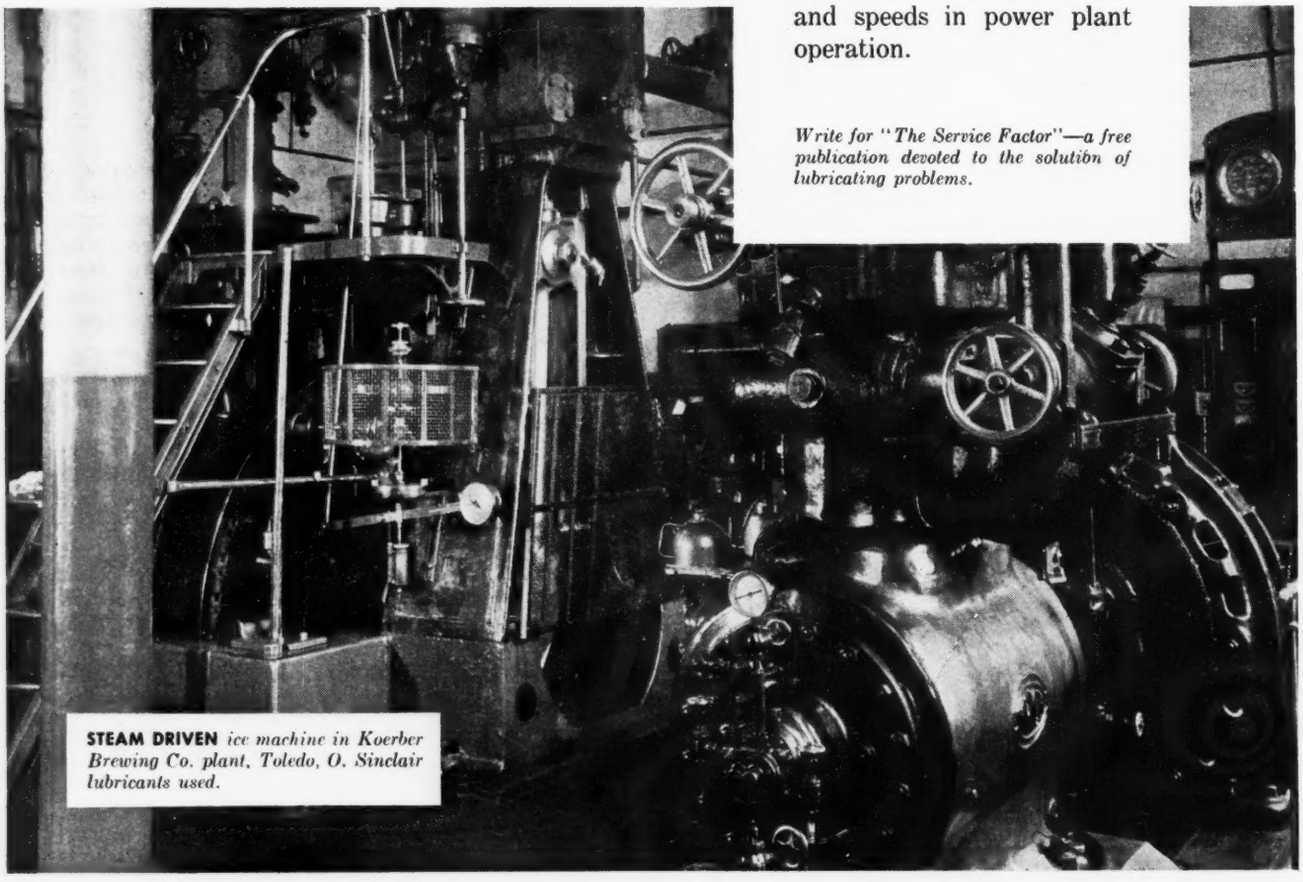


ALL-OUT WAR EFFORT demands maximum engine performance. For lubrication that helps *STEAM ENGINES* to deliver sustained full power output use . . .

. . . SINCLAIR STEAM CYLINDER and VALVE OILS. They are designed to meet every requirement of pressures, temperatures, moisture conditions, loads and speeds in power plant operation.

Write for "The Service Factor"—a free publication devoted to the solution of lubricating problems.



STEAM DRIVEN *ice machine in Koerber Brewing Co. plant, Toledo, O. Sinclair lubricants used.*

SINCLAIR INDUSTRIAL OILS

FOR FULL INFORMATION OR LUBRICATION COUNSEL WRITE NEAREST SINCLAIR OFFICE

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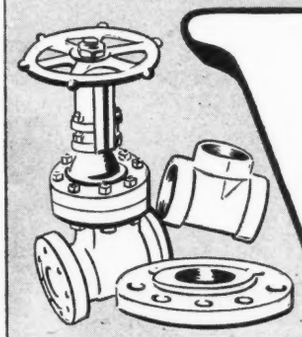
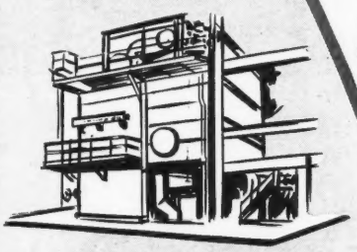
WAR PRODUCTION COMES *FIRST!* . . .

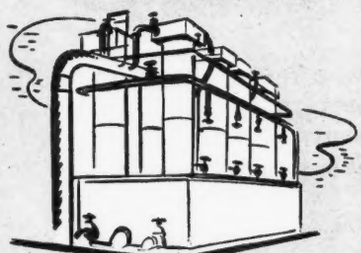


DROP FORGED STEEL VALVES, FITTINGS AND FLANGES

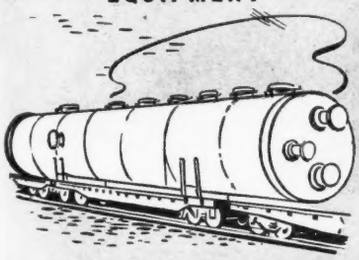


WATER TUBE BOILERS

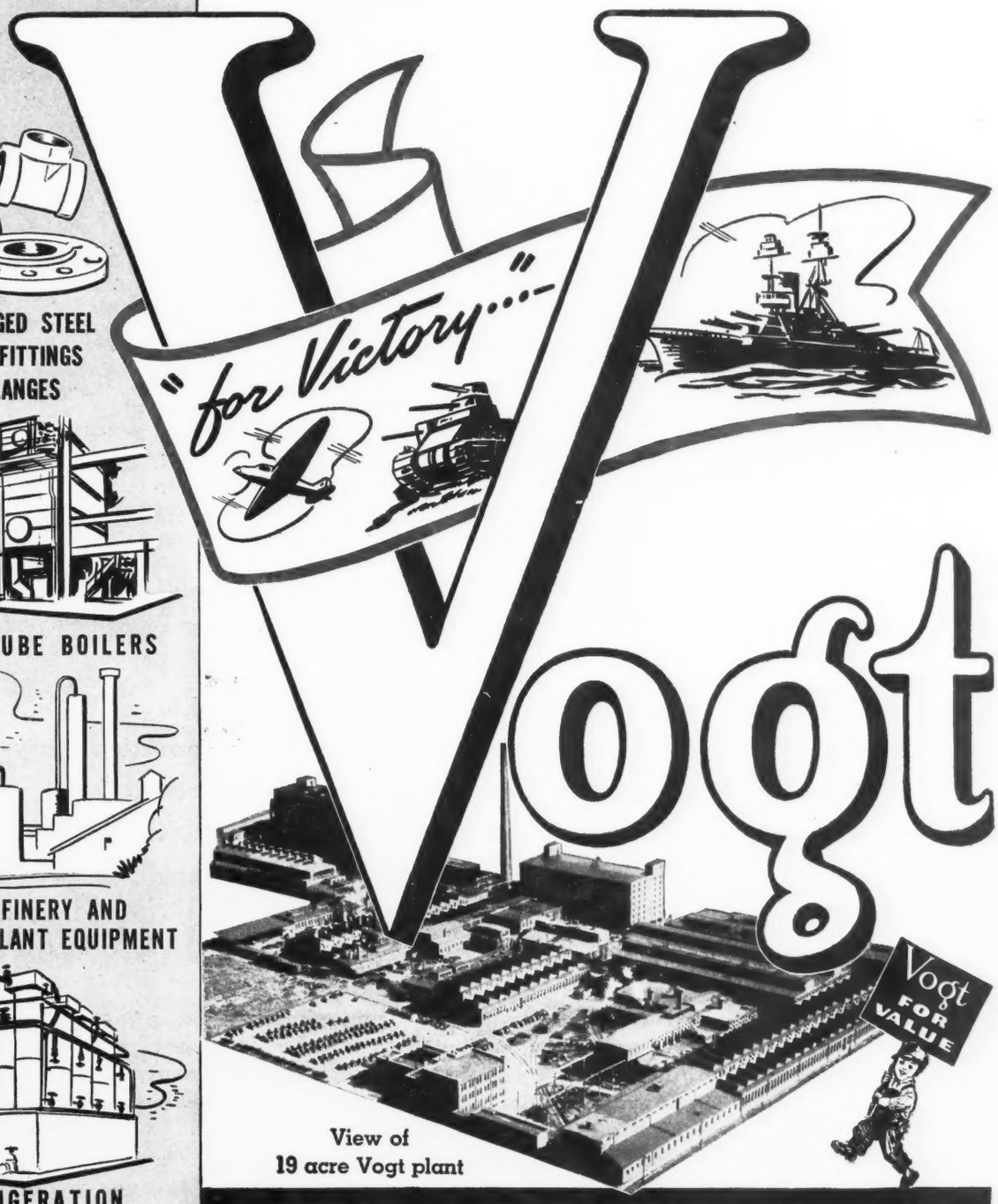
OIL REFINERY AND CHEMICAL PLANT EQUIPMENT



REFRIGERATION EQUIPMENT



WELDED PRODUCTS



View of 19 acre Vogt plant

HENRY VOGT MACHINE CO., INC.

LOUISVILLE, KENTUCKY

NEW YORK • CHICAGO • CLEVELAND • PHILADELPHIA • DALLAS

At Vogt's the production of essential equipment for VICTORY comes FIRST and is reaching new highs every week.

No effort is spared to deliver the goods on time and to maintain the quality of products necessary to the success of the war program.

Consolidated Aircraft Corporation's new airplane plant . . . engineered and built by the Austin Company.

KEYNOTE in the construction of this vast plane factory has been "Controlled Conditions." Light, sound, atmosphere . . . all are controlled to provide uniform working and equipment conditions 24 hours per day, 365 days per year.

Worthington's part in this tremendous undertaking has been the furnishing of the refrigerating equipment for the air conditioning system, the fire pumps, and additional pumps for water circulation.

In manufacturing and installing the equipment, it has been our privilege to work closely with the executives and engineers of The Austin Company, and we are pleased to congratulate their organization on this noteworthy achievement.

TODAY, practically the entire output of Worthington's five plants flows directly into the war production program . . . for the Army and Navy themselves, or as essential equipment for the munitions, steel, petroleum, chemical, and many other industries, and as the basic equipment of such vital public services as power, water supply, and sanitation, for concentrations of war workers.

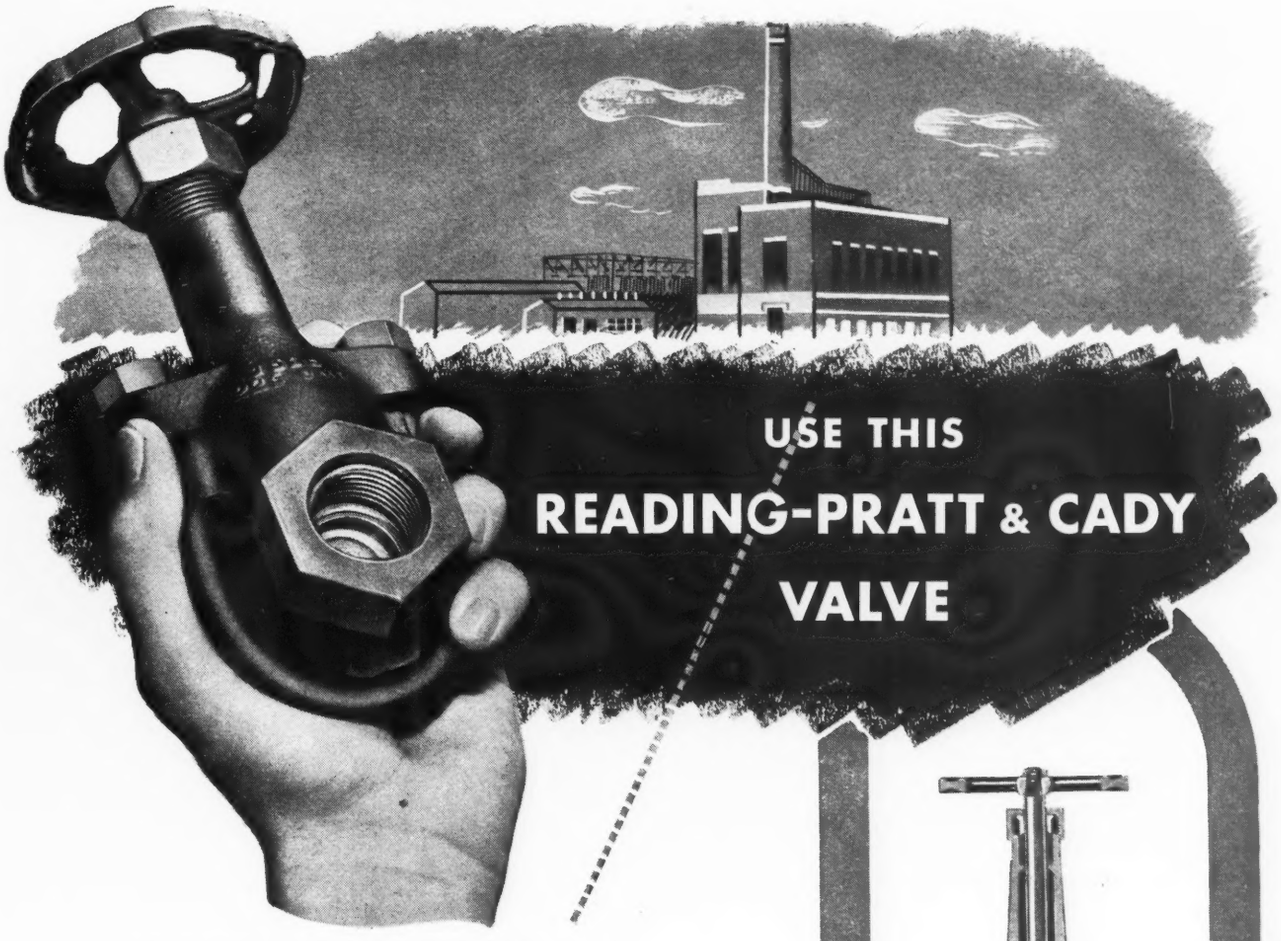
It is significant that Worthington's ability to produce many and varied items of important equipment *now* is the result of having maintained, through past years of prosperity and depression, an organization which is manned and tooled to do its job when called upon in peace or war.

For the solution of war production problems in air conditioning, power generation and transmission, liquid transfer and metering, and construction, Worthington equipment is now available. Our engineers are ready to assist in planning, plant expansion or conversion.

WORTHINGTON

2-8A

WORTHINGTON PUMP AND MACHINERY CORPORATION • HARRISON, NEW JERSEY



USE THIS READING-PRATT & CADY VALVE

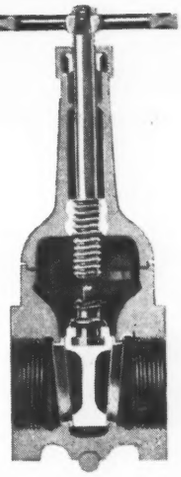
AS PART OF YOUR PROGRAM TO SWING TO ALTERNATIVE MATERIALS FOR THE DURATION

Wherever you need Clip Gate Valves of any size—*even smaller sizes*—turn your thoughts away from bronze bodies. The increasing war tempo has placed the supply of brass and bronze in an even more critical position.

You will be much more likely to get delivery if you use, as an alternative, valves with bodies of P&C High Test Iron.

If bronze trim is imperative, the spindle will be of P&C High Tensile Rolled Bronze. The Follower, cast-in bonnet bushing, renewable seat rings and reversible I-beam wedge will be P&C Special Valve Bronze. That sounds like a great deal of critical material. Actually, it represents scarcely ¼ of the total weight of the valve.

Bear in mind, of course, that, even where it is possible to obtain release of materials for you, deliveries are subject to the fact that in this plant the needs of America's Army and Navy—and those working directly on war production, have first call. We are doing everything within our power as manufacturers of valves and fittings to speed the day when Victory brings Peace.



P&C Figure 122-C
Iron Body Clip Gate Valve

Bronze mounted and all iron. Working pressures; 150 lbs. of steam; 225 lbs. OWG. Sizes; ¼" to 3".

Note the round bonnet which permits use of male and female bonnet joint with asbestos gasket and which assures tightness. Full U-Bolt equalizes pressure on both sides. Body guide lugs and closed bonnet eye-lugs prevent slippage. Heavy I-beam wedge. Full size body guides for wedge. P&C assembly of spindle and wedge provides great strength.

Bonnet bushing is cast in.

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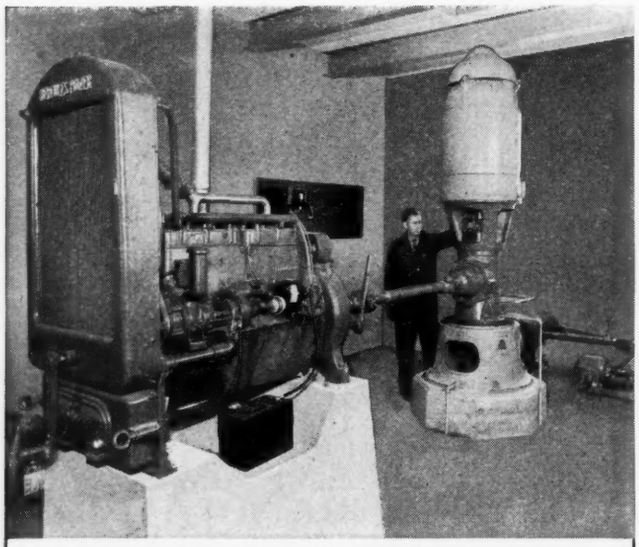

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The Deming Turbine Pump illustrated above is vital equipment in furnishing a continuous water supply service on a "round the clock" schedule of wartime operations.

A 100 H.P. electric motor of standard make is integral with the Deming Turbine Pump. A "stand-by" gasoline engine is connected to the Deming Pump. If electric power fails from any unforeseen cause, the "stand-by" gasoline engine goes into action immediately.

Features of Deming Turbines are engineered to assure high standards of pumping efficiency. A complete description of these water lubricated, deep well pumps is contained in illustrated Bulletin 4700-8. Write for a copy.

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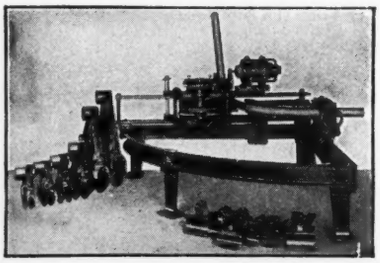

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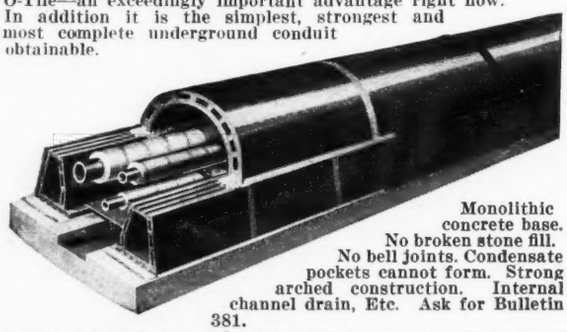

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Without obligating us in any way, ☐ Please send Bulletin 381. ☐ Send representative. ☐ Enclosed is a sketch, with principal data of a prospective job, on which we shall be glad to have your ☐ comments, ☐ quotations.

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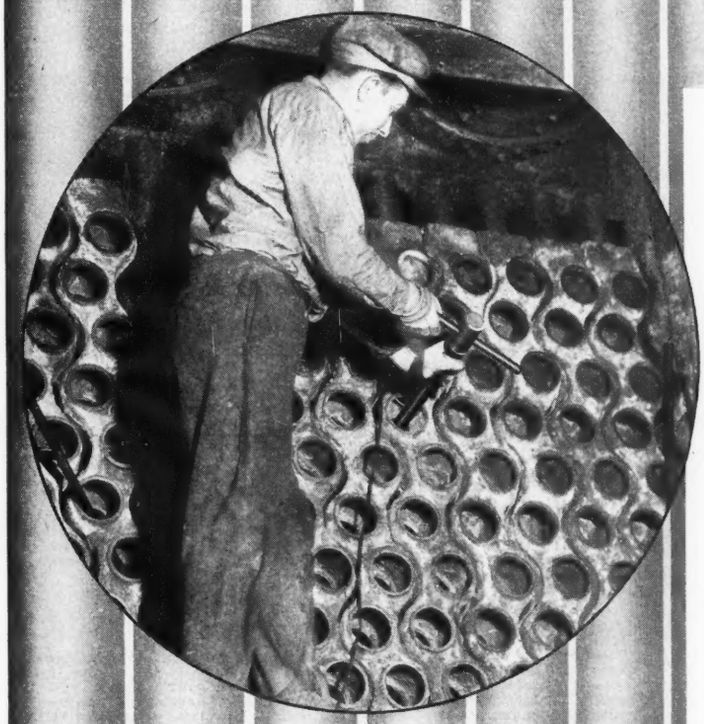
TIME, TUBES *and* DEPENDABILITY



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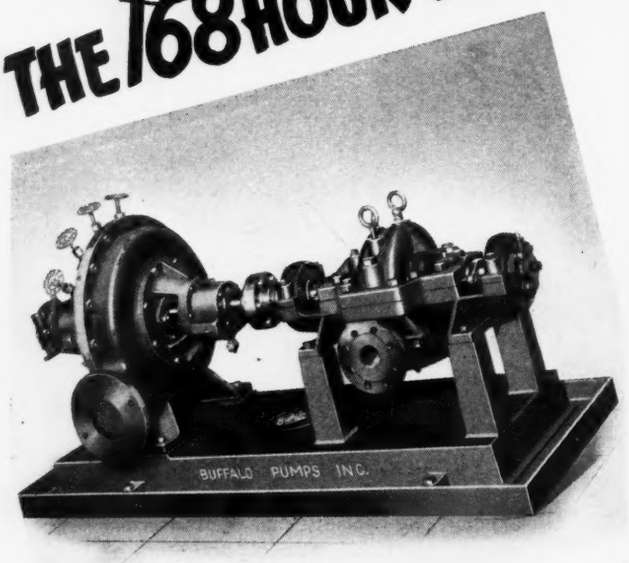

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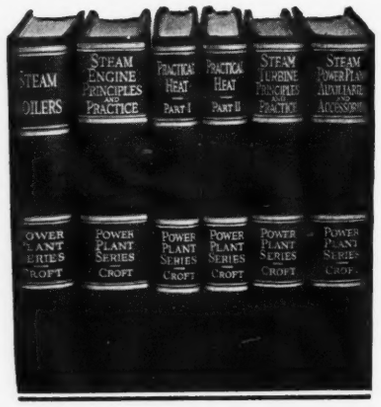
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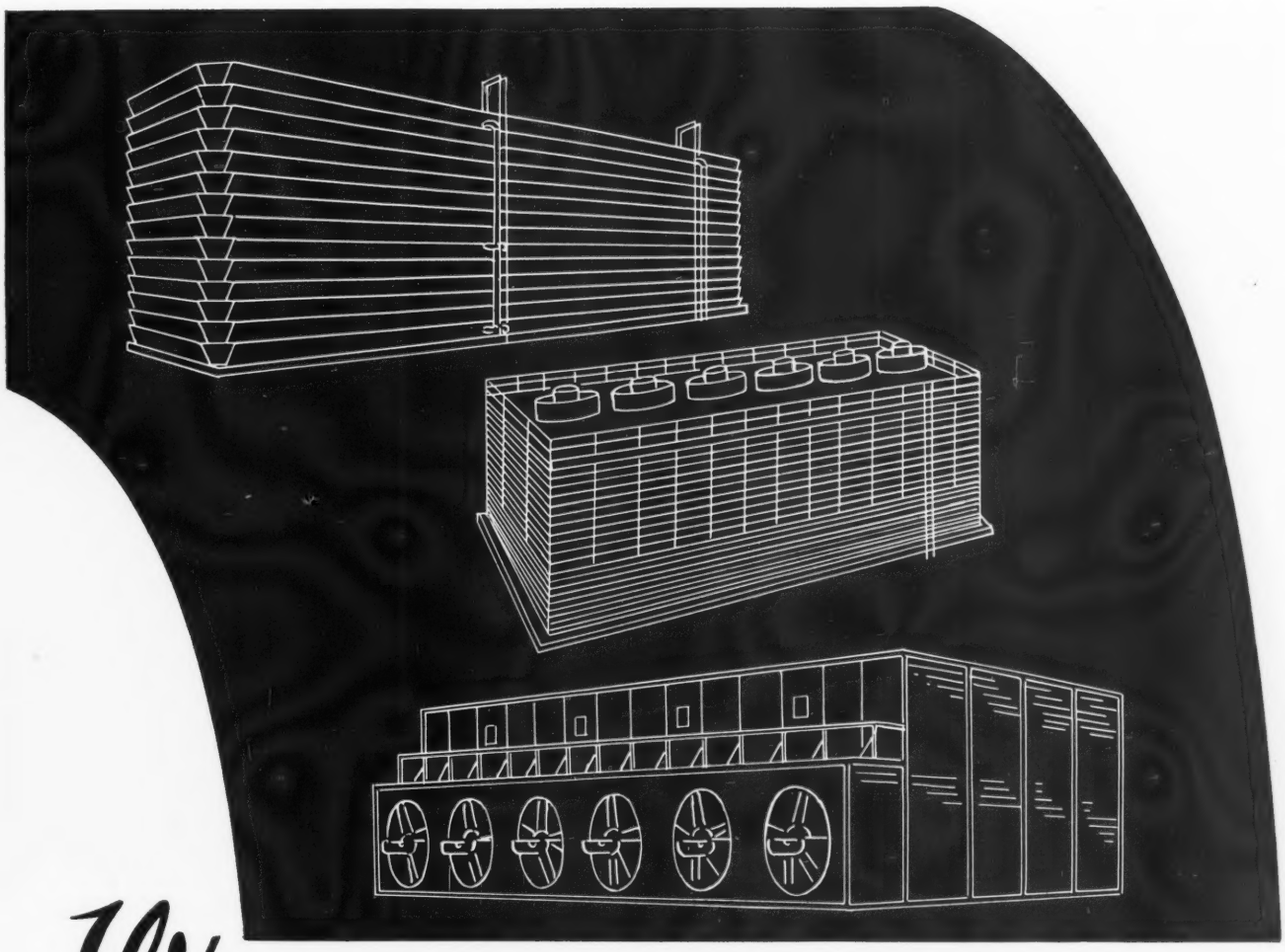

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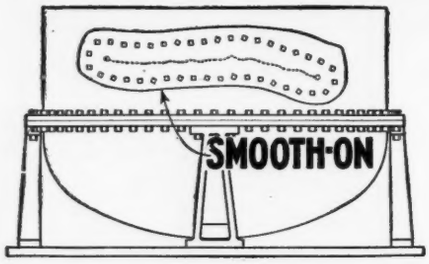

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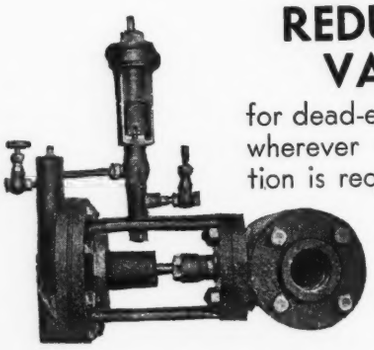

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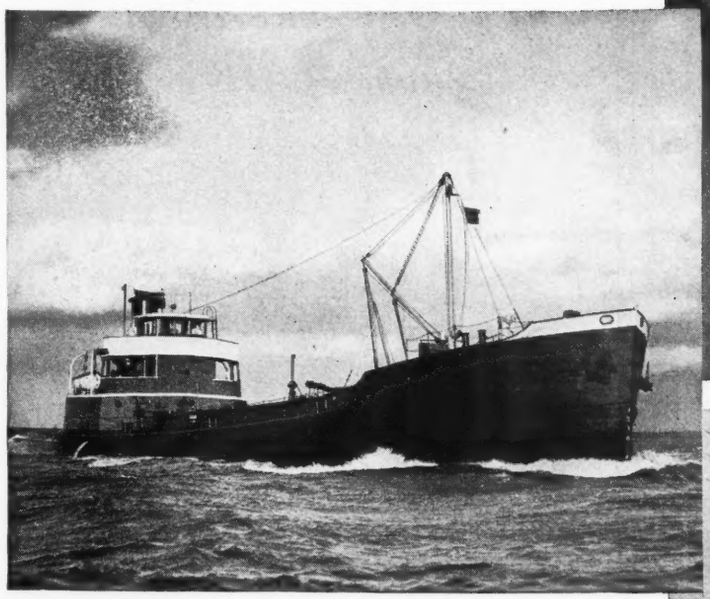

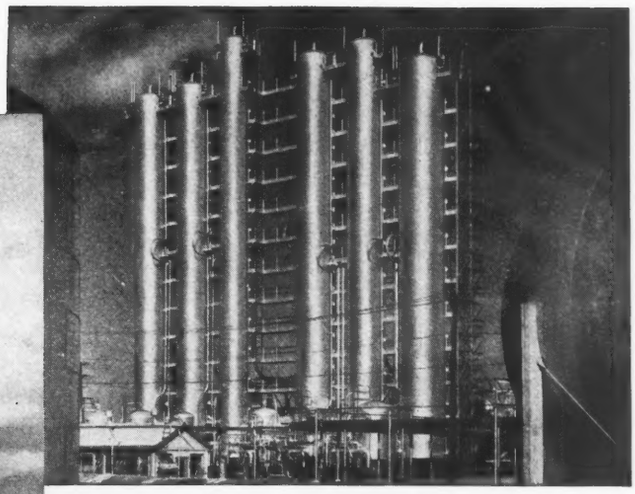

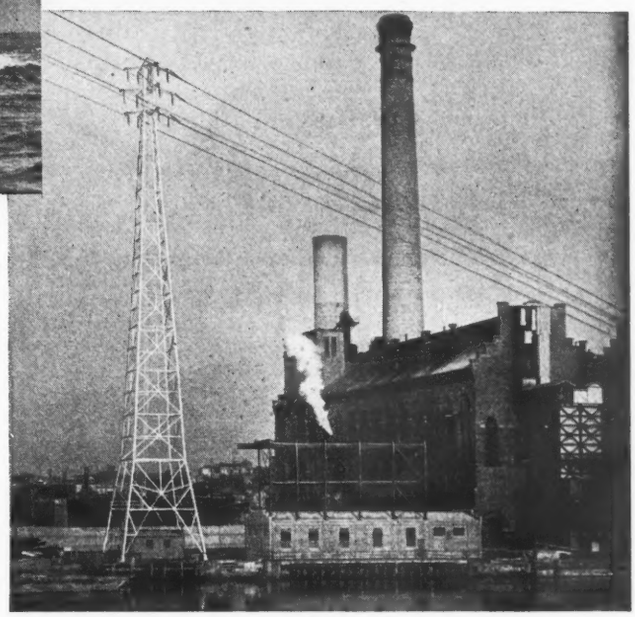

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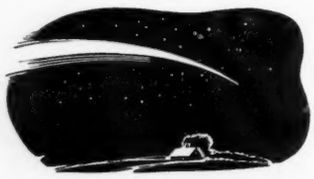

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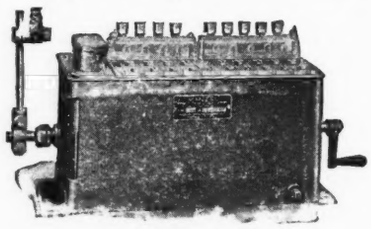

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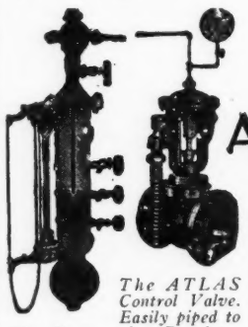

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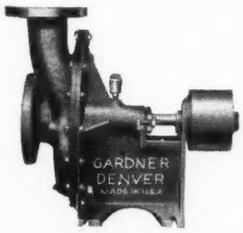
2. Horizontally split casings permit easy access to rotating element without disturbing connections.
3. Cast bronze, enclosed type, hydraulically balanced, double-suction impeller.
4. Heavy-duty, single row, ball bearings absorb line and thrust loads.
5. Designed for heads up to 350 feet.



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4. Volute can be rotated so that pump discharge is located in any of 16 positions.
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2. Pumps may be installed in any position on floor, wall or ceiling—either horizontally or vertically.
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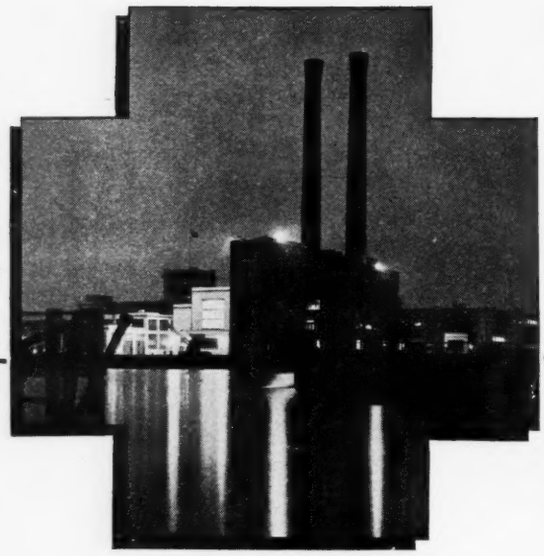

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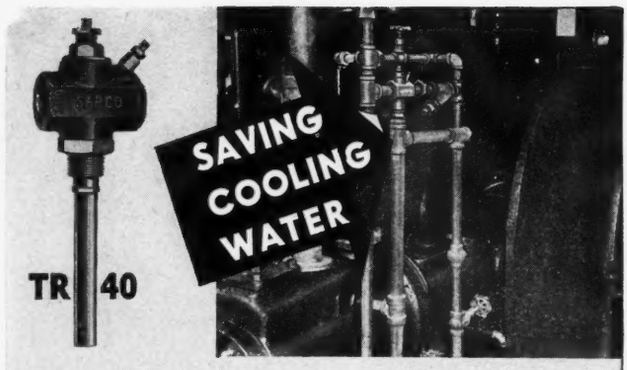

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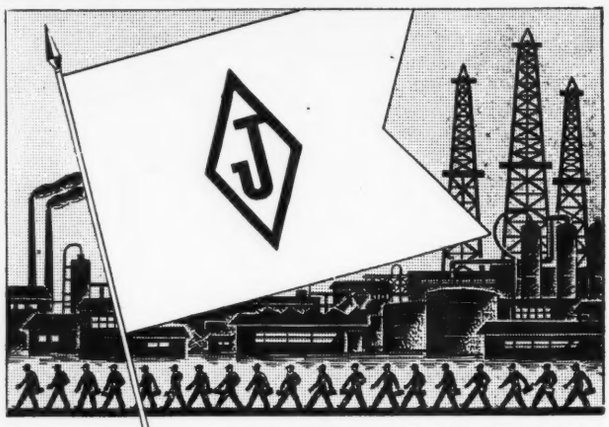

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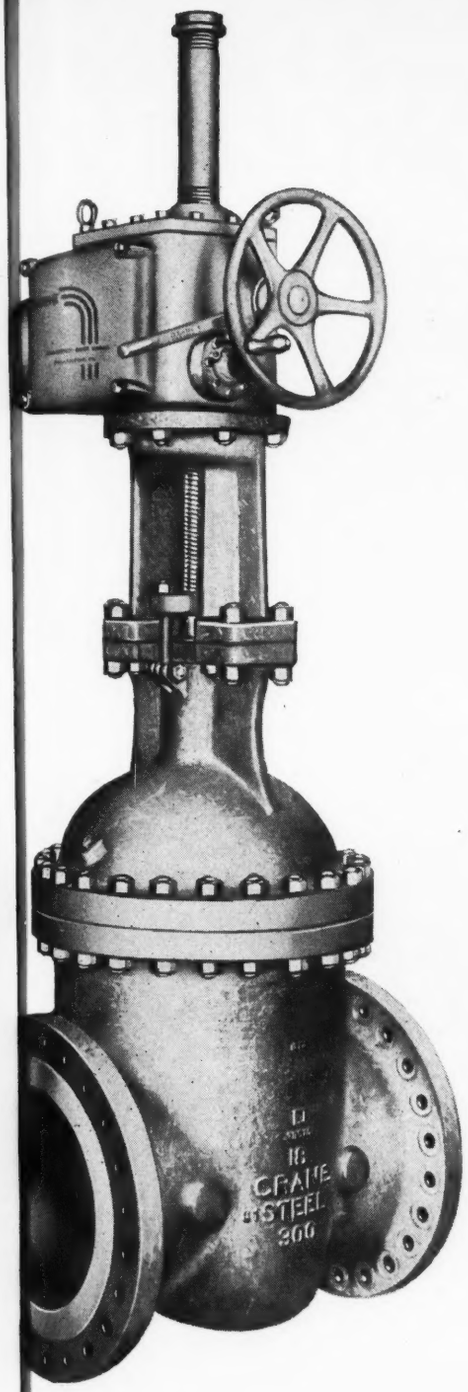

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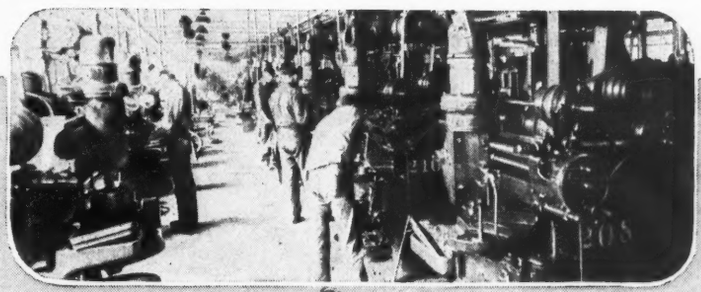

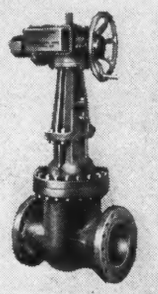

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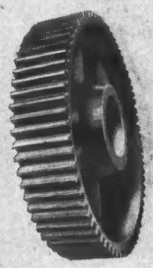

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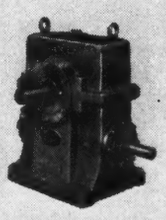

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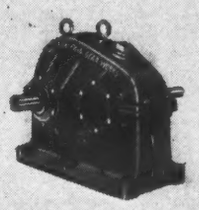

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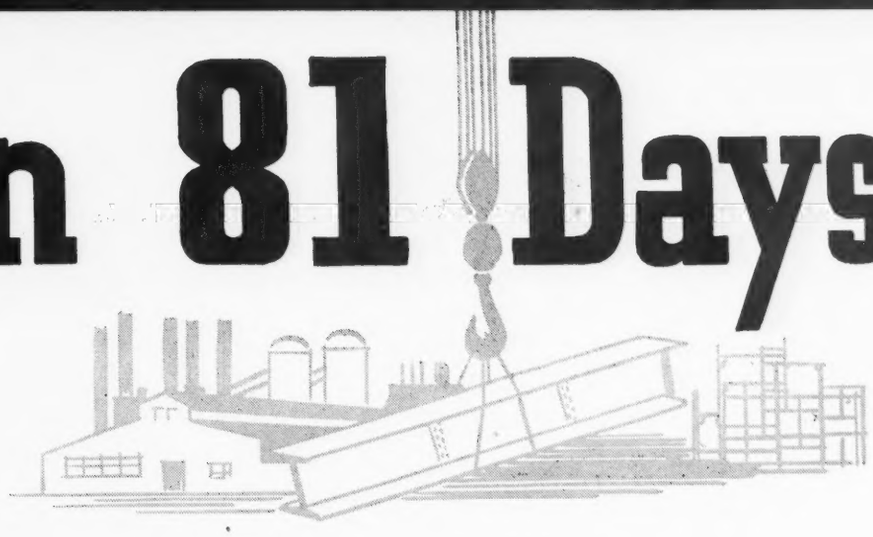

TO MEET the demands of the war steel production program, the Carnegie Illinois Steel Corporation recently required additional volume of natural gas for their mills in the Pittsburgh area. It was essential that the increased supply become available not later than December 15th, 1941.

On September 16th, authorization was issued to construct an 1800 H.P. compressor plant on the United Fuel Gas Company's 16-inch line to the Pittsburgh area, — which would increase the line's capacity about 15 Million CF per 24 hours. The same day Clark Bros. received an order for the installation of three 600 H. P. "Angle" Compressors needed.

The station was completed and ready for operation December 5th, 81 days after the authorization was issued and 10 days ahead of the requirement. Special credit for this achievement was due D. S. Keenan, President of Carnegie Natural Gas Company, H. M. Baker, chief engineer of the United Fuel Gas Company, and the Clark engineering department.

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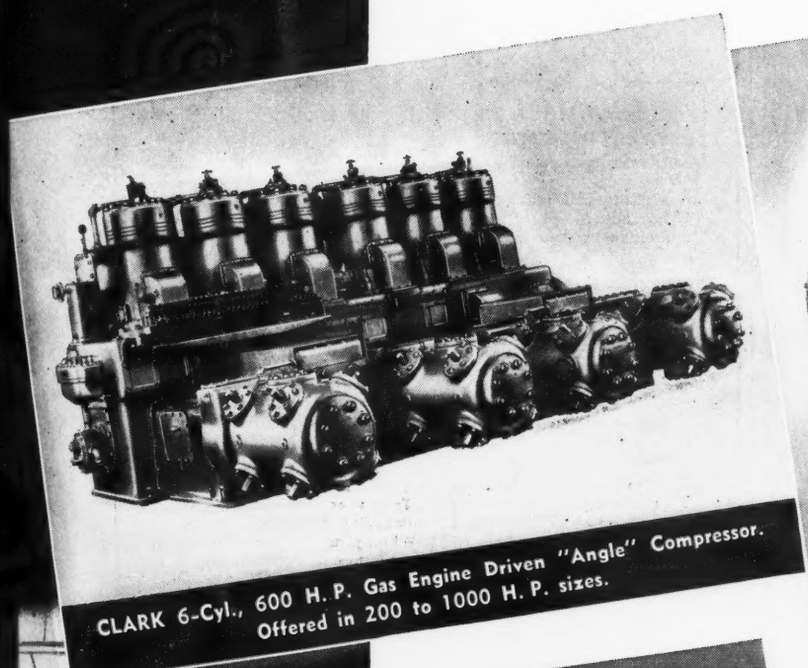
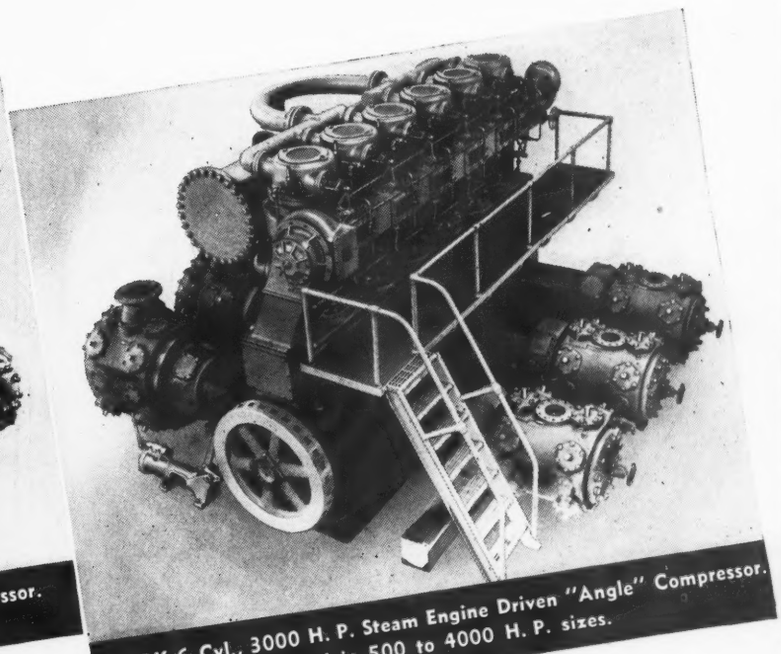


CLARK 6-Cyl., 600 H. P. Gas Engine Driven "Angle" Compressor.
Offered in 200 to 1000 H. P. sizes.



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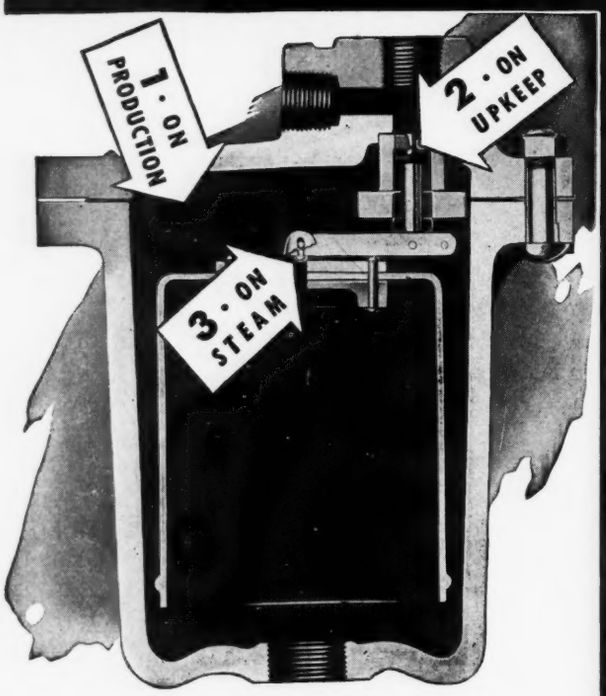

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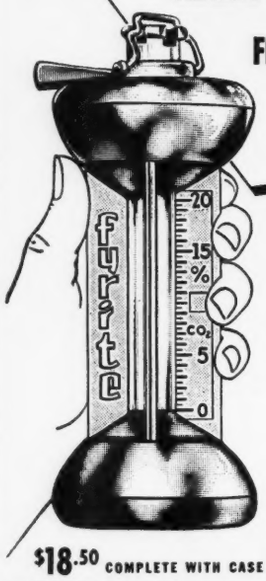

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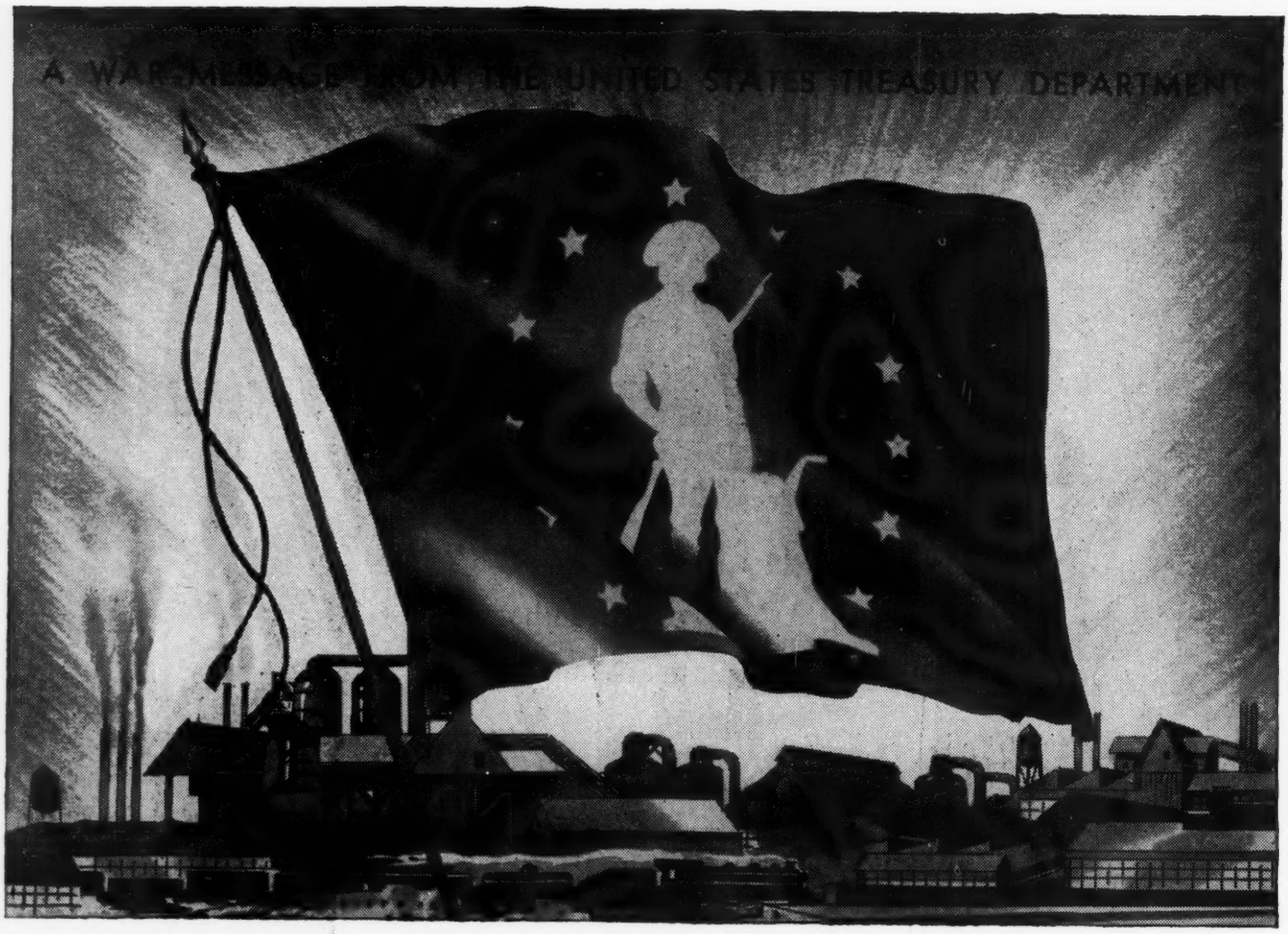

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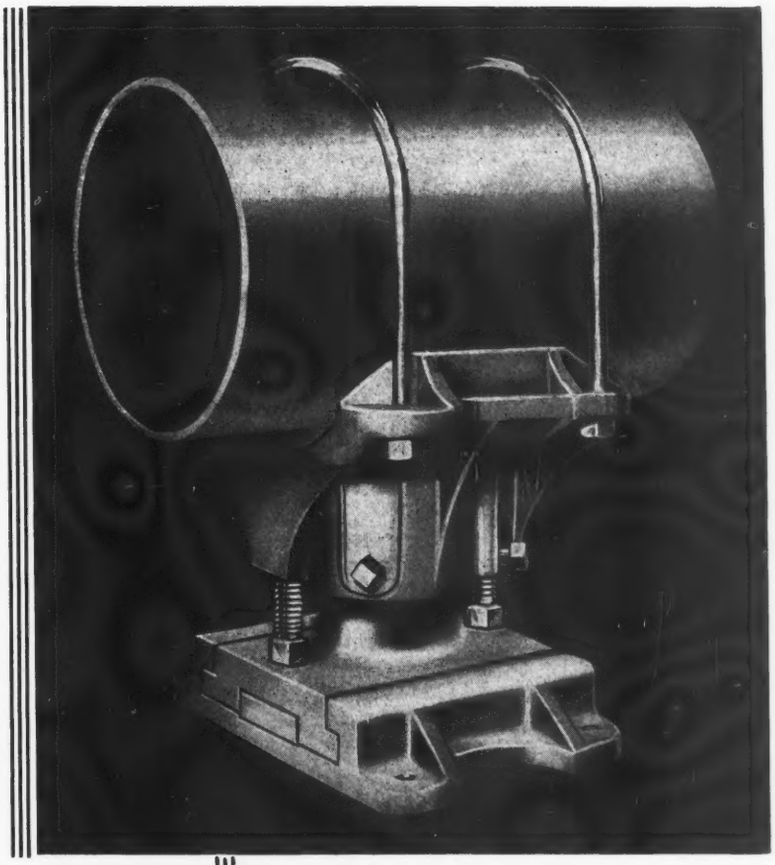

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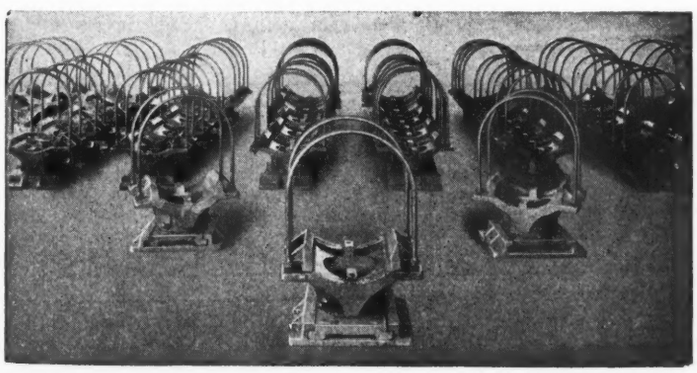

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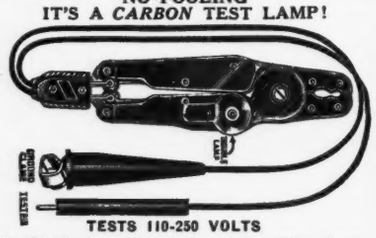

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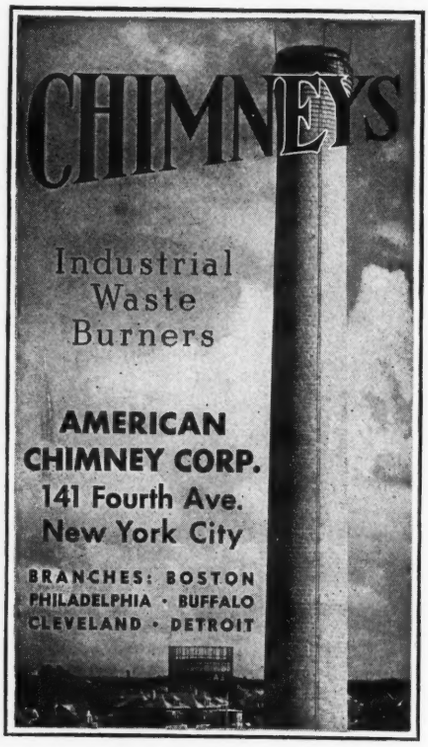

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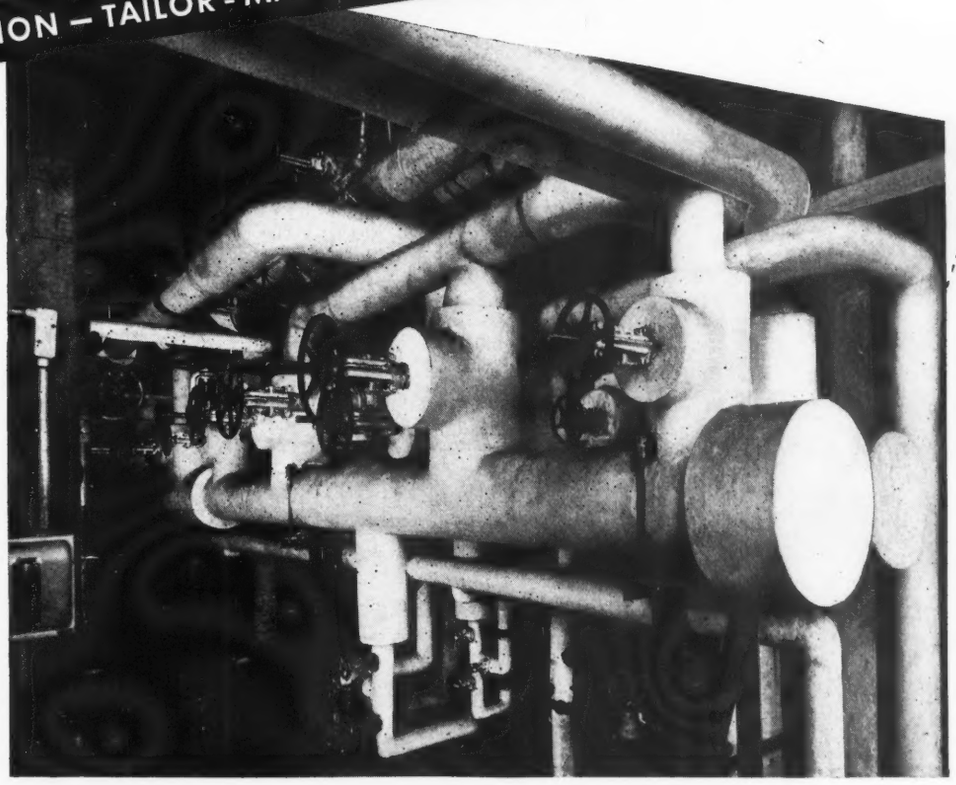
INSULATION — TAILOR-MADE FOR WAR TIME PROBLEMS! unibestos



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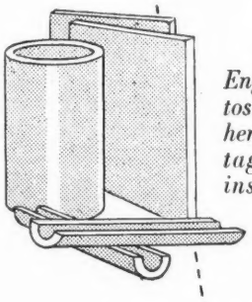

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(b) Lower heat loss.

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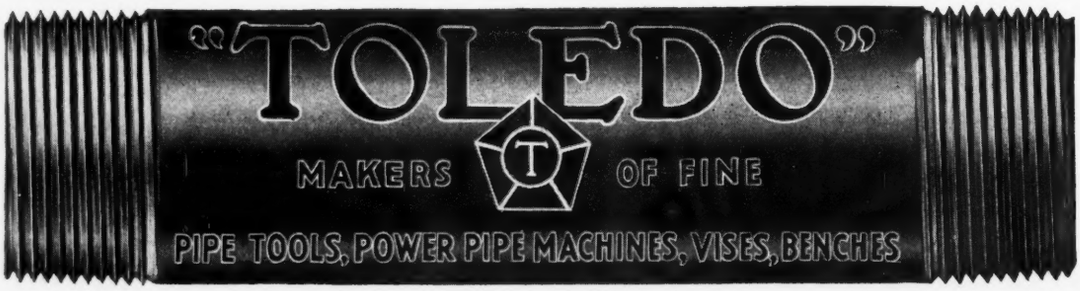

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A limited amount of dust clings to the outside of the filter medium during use. This amount is limited by vibration transmitted from the engine, which shakes off most of the dust. The remainder acts as a filter, *increasing* efficiency with use instead of decreasing it, as in liquid-type filters.

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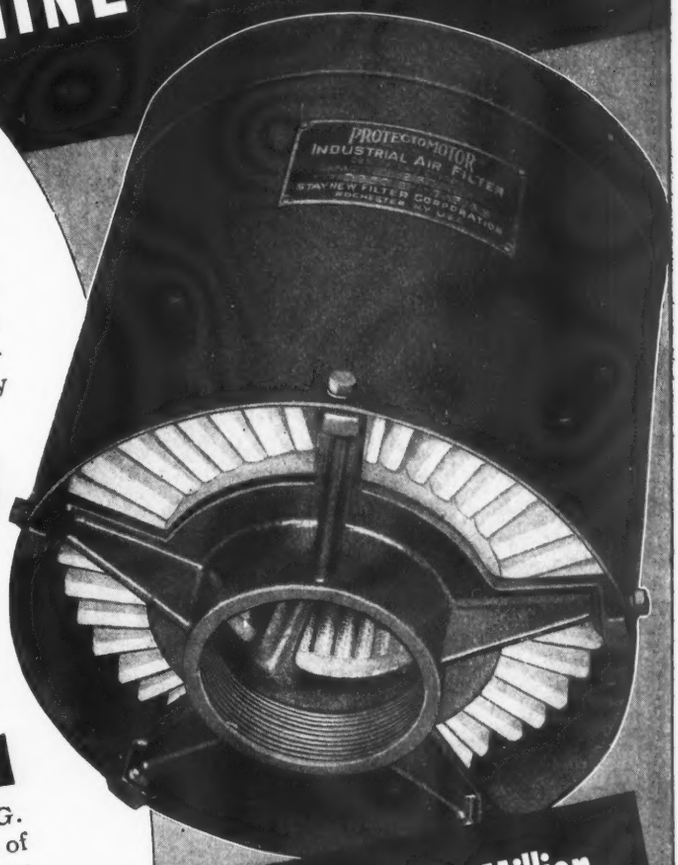
Protectomotors used as rated offer *only* ½" *W. G. restriction to air flow*, yet after months or years of use this restriction will not increase to more than an inconsequential 1" W.G.—remaining at this point during the life of the filter—due to the Radial Fin Construction which permits the largest possible area of filtering surface to be used in the smallest possible space, plus the shaking action of engine vibration on the vertical fins.

★ SERVICING SELDOM NECESSARY

The Protectomotor is a masterpiece of simple, rugged construction. There are no moving parts, no reservoirs, no liquids. The only servicing ever required is the removal of the Insert for cleaning—perhaps once a year under average conditions. Cleaning can usually be effected in 5 or 10 minutes with compressed air or a stiff brush.

★ EFFICIENT AT SUB-ZERO TEMPERATURES

This dry-type filter maintains peak efficiency at the lowest or highest atmospheric temperatures. Protectomotors are giving complete satisfaction on compressors and engines from the Equator to the Arctic Circle.



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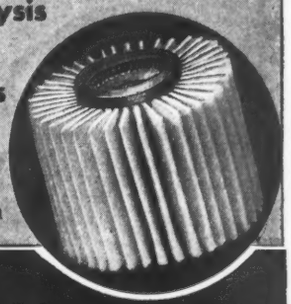

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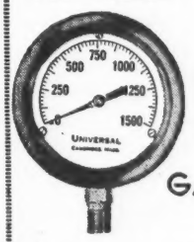

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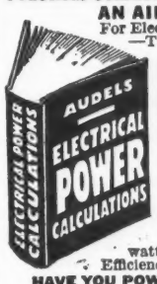

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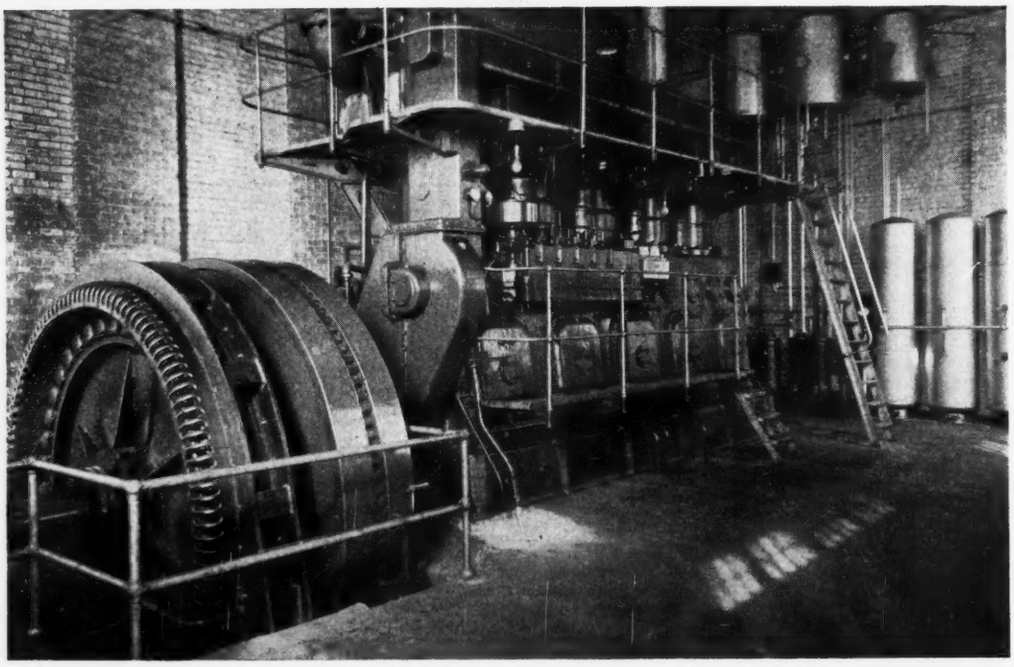

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800 KVA WESTINGHOUSE-DE LA VERGNE FULL DIESEL OIL ENGINE UNIT

800 KVA WESTINGHOUSE alternating current generator type ES 3 phase 60 cycle 600/2300 volts 180 RPM direct connected to 940 HP De La Vergne full diesel oil engine type I model VB 5 cylinder 180 RPM.

The above unit is complete with all accessories as in operation. Installed new 1932.

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3 Phase 60 Cycle

1563 KVA ALLIS CHALMERS, 2400/600 volts, 257 RPM

1250 KVA ALLIS CHALMERS, 2400/600 volts, 257 RPM

625 KVA WESTINGHOUSE-AMES 4 cylinder vertical uniflow, 150-175 lbs. 0-5 lbs., back pressure, 2300/600/480/240 volts

500 KVA GENERAL ELECTRIC-AMES 4 cylinder vertical uniflow, 150-175 lbs., 0-10 lbs. back pressure, 2300/600/480/240 volts

438 KVA GENERAL ELECTRIC-SKINNER Uniflow, 150-175 lbs., 0-5 lbs. back pressure, 2300/600/480/240 volts

210 KVA GENERAL ELECTRIC-AMES Uniflow, 125-150 lbs., 0-5 lbs. back pressure, 2300/600/480/240 volts

210 KVA GENERAL ELECTRIC, 2300/600/480/240 volts, 225 RPM

BOILERS

728 HP ERIE CITY water tube boiler, AMSE code, 200 lbs. pressure, less stoker equipment

500 HP HEINE water tube boiler, 200 lbs. pressure with superheater and coal pulverizer

500 HP (2) EDGEMOOR water tube boilers, 200 lbs. pressure equipped with superheaters and Riley underfed stokers

420 HP B & W water tube boiler, ASME code, 200 lbs. pressure, less stoker equipment

370 HP WICKES single cross drum water tube boiler, ASME code, 350 lbs. pressure 600 deg. F TT, with superheater, gas and oil burner.

ALTERNATING CURRENT TURBO GENERTORS

3 Phase 60 Cycle

2500 KVA WESTINGHOUSE condensing, 150-200 lbs. pressure 100 deg. superheat with surface condenser; 2300 volts

1250 KVA ALLIS CHALMERS condensing, 150-200 lbs. pressure 100 deg. superheat with jet condenser; 2300 volts

625 KVA GENERAL ELECTRIC condensing, 150-400 lbs. pressure 600 deg. TT with surface condenser; 2300 volts

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125/250 Volts 3-Wire

150 KW CROCKER WHEELER-AMES 3 cylinder vertical Uniflow, 200-250 lbs., 0-8 lbs. back pressure

125 KW CROCKER WHEELER-AMES 3 cylinder vertical Uniflow, 200-250 lbs., 0-8 lbs. back pressure.

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ROTARY CONVERTERS

60 Cycle

3500 KW (2) WESTINGHOUSE, 225-285 volts D.C., 225 RPM with 3 phase 60 cycle 13200 volt transformers

2500 KW WESTINGHOUSE, 600 volts D.C., 400 RPM with 3 phase 60 cycle 11000 volt transformers

1500 KW WESTINGHOUSE, 225-285 volts D.C., 450 RPM with 3 phase 60 cycle 2300/4000-6900/12000 volt transformers

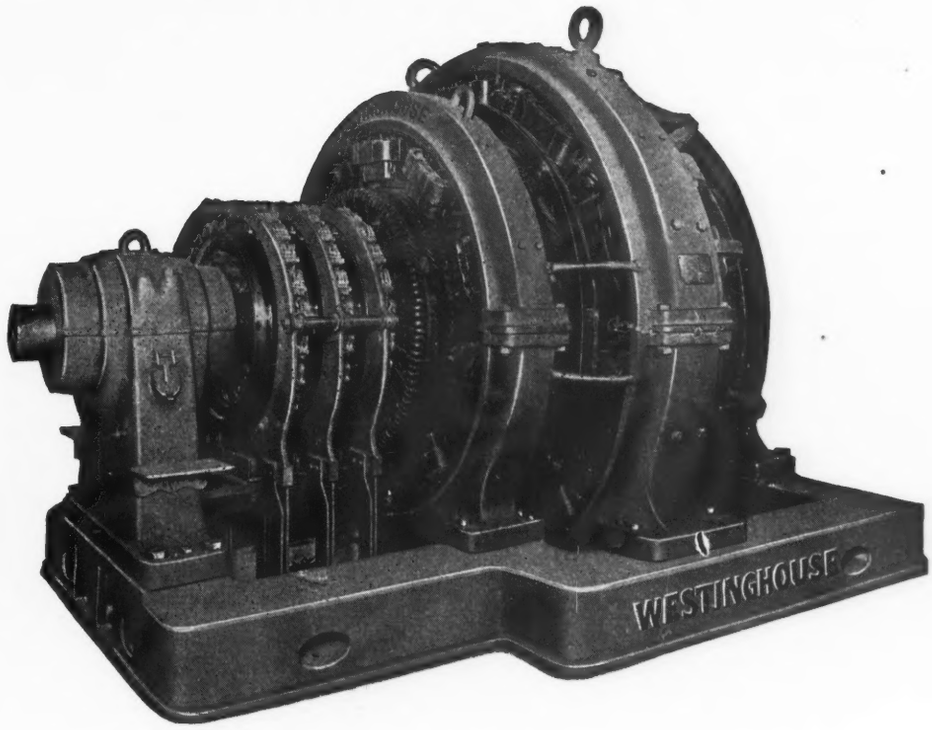
750 KW GENERAL ELECTRIC, 600 volts D.C., 1200 RPM with 3 phase 60 cycle 2300/4000 volt transformers

300 KW WESTINGHOUSE, 600 volts D.C., 1200 RPM with 3 phase 60 cycle 13200 volt transformers

ROTARY CONVERTER

25 Cycle

1500 KW WESTINGHOUSE, 600 volts D.C., 500 RPM with 3 phase 25 cycle 11000 volt transformer



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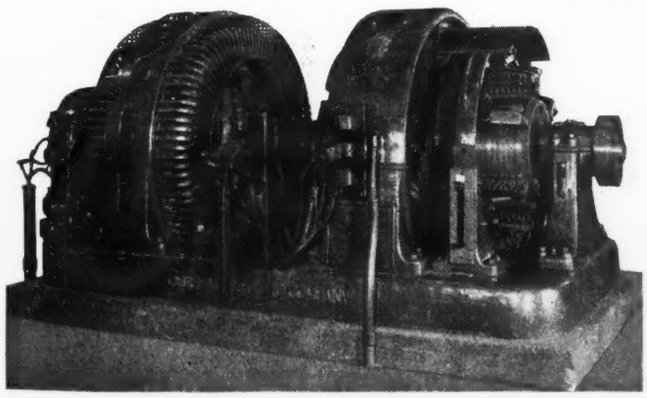
1500 KW WESTINGHOUSE ROTARY CONVERTER

1500 KW WESTINGHOUSE interpole rotary converter, 225/285 volts DC 450 RPM; 6 phase 60 cycle A.C. 2300/4000-6900/12000 volt transformers. Complete with control.

MOTOR GENERATOR SETS

3 Phase 60 Cycle



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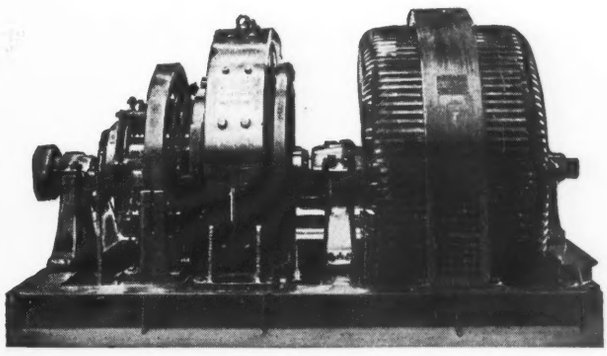
750 KW GENERAL ELECTRIC MOTOR GENERATOR SET

750 KW GENERAL ELECTRIC direct current generator, 600 volts 720 RPM direct connected to 1100 HP 80% P.F. General Electric synchronous motor 3 phase 60 cycle 2300 volts 720 RPM. Equipped with D.C. control panel and starting equipment.



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1000 KW GENERAL ELECTRIC MOTOR GENERATOR SET

1000 KW GENERAL ELECTRIC direct current generator, 125/250 volts 3-wire 720 RPM direct connected to 1400 HP 80% P.F. General Electric synchronous motor 3 phase 60 cycle 13200/6600 volts 720 RPM. Equipped with D.C. breakers.

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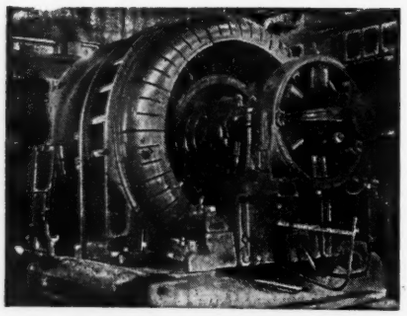


MOTOR GENERATOR SETS

1—500 KW, 650 volt, General Electric, syn.
1—100 KW, 250 volt, synchronous.
1—100 KW, 125 volt, Westinghouse, syn.
1—100 KW, 125/250 volt, Allis Chalmers, squirrel cage.
1—50 KW, 250 volt, General Electric, sq. cg.
1—35 KW, 125 volt, El. Mach., sq. cg.
1—10 KW 125 volt Electric Machinery

D. C. GENERATORS

1—100 KW, 750 RPM, 125 volt, West. Elec.
1—100 KW, 600 RPM, 125/250 volt, G.E.
1—75 KW, 260 RPM, 250 volt, Westinghouse.
1—67½ KW, 700 RPM, 45 volt, Gen. Elec.
2—32 KW, 650 RPM, 125 volt, Westinghouse.

MOTORS—3 PHASE 60 CYCLE

1—720 HP, 360 RPM, 440 volt, G.E., syn.
1—500 HP, 450 RPM, 2200/4000 volt, G.E., slip ring.
1—400 HP, 514 RPM, 440 volt, Westg., sl. rg.
1—350 HP, 300 RPM, 440 volt, G.E., slip ring.
1—350 HP, 100 RPM, 220/440 volt, G.E. syn.
1—335 HP, 600 RPM, 2300 volt, G.E., syn.
1—250 HP, 450 RPM, 220 volt, G.E., slip ring.
1—250 HP, 360 RPM, 440 volt, Westg. sq. cg.
1—250 HP, 514 RPM, 4000 volt, G.E., syn.
1—200 HP, 900 RPM, 440 volt, Westg., sl. rg.
1—200 HP, 600 RPM, 2200 volt, G. E., sl. rg.
1—200 HP, 450 RPM, 2200/4000 v., G.E., sl. rg.
1—200 HP, 514 RPM, 4000 volt, G.E., syn.
1—175 HP, 900 RPM, 440 volt, Westg. syn.
1—150 HP, 1800 RPM, 2300 volt, Allis Chal. sq. cg.
1—150 HP, 900 RPM, 440 volt, Allis Chal. sl. rg.
2—150 HP, 720 RPM, 220 v., Elec. Mach. syn.
1—150 HP, 720 RPM, 440 volt, G E., slip ring.
1—150 HP, 600 RPM, 440 volt, G.E., slip ring.
1—150 HP, 400 RPM, 440 volt, G.E., sq. cg.
2—125 HP, 720 RPM, 440 volt, G.E., slip ring.
2—125 HP, 450 RPM, 440 volt, G.E., syn.
1—100 HP, 1800 RPM, 440 v., Allis Chal. sq. cg.
1—100 HP, 900 RPM, 220 volt, G.E., sq. cg.
1—100 HP, 900 RPM, 440 volt, G.E., slip ring.
3—100 HP, 720 RPM, 440 volt, G.E., slip ring.
1—100 HP, 720 RPM, 440 volt, G E., sq. cg.
1—100 HP, 600 RPM, 440 volt, G.E., slip ring.
1—100 HP, 600 RPM, 440 volt, G.E., sq. cg.

MOTORS—3 PHASE 60 CYCLE—(Continued)

1—100 HP, 514 RPM, 440 volt, G.E., sq. cg.
2—100 HP, 450 RPM, 440 volt, G. E., sq. cg.
1—75 HP, 1800 RPM, 220/440 v., G. E., sq. cg.
1—75 HP, 900 RPM, 4000 v., Elec. Mach. syn.
1—75 HP, 900 RPM, 440 volt, G.E., enclosed, fan cooled, squirrel cage.
1—75 HP, 900 RPM, 220 volt, Fairbanks-Morse, slip ring.
1—75 HP, 900 RPM, 2200 volt, G.E., slip ring.
1—75 HP, 514 RPM, 440 volt, G.E., sq. cg.
1—60 HP, 1750 RPM, 220 volt, G.E., sq. cg.

MOTORS—D. C. 230 VOLTS

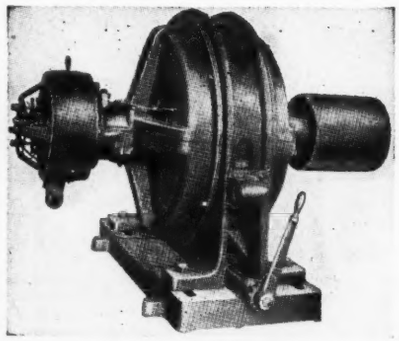
1—125 HP, 850 RPM, G.E., type CD.
100 H.P. G. E. 575 RPM
1—65 HP, 1000 RPM, G. E., type RC.
1—50 HP, 1100 RPM, Crocker Wheeler.
1—50 HP, 750 RPM, Westinghouse, type SK.
1—50 HP, 700 RPM, Crocker Wheeler.
50 H.P. 750 RPM. G. E. CO1829
45 H.P. 1300 G. E. Type RC
1—40 HP, 1100 RPM, G.E., type RC.
1—40 HP, 300 RPM, General Electric.
1—30 HP, 750 RPM, G.E., type RC.
1—30 HP, 725 RPM, Westinghouse, type SK.

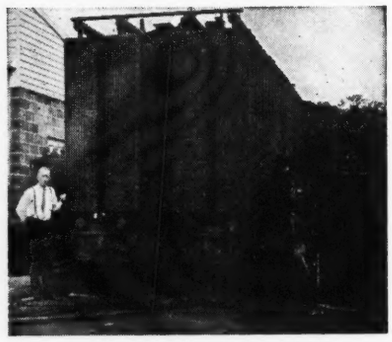
TURBO-GENERATORS

2—1000 KW, 3 ph., 60 cy., 2300/4150 v., cond.
1—500 KW, G.E., 3 ph., 60 cy., 480 volt, bleeder.
1—375 KVA, Westinghouse, non-condensing.
1—300 KW, G.E., 3 ph., 60 cy., 220 v. cond.
1—200 KW, G.E., 3 ph., 60 cy., 220 volt, cond.
1—150 KW, 125/250 volt, Westg., non-cond.
1—100 KW, 125 volt, Westg., non-cond.

MOTORS—VARIABLE SPEED 230 VOLTS

2—100 HP, 475/1375 RPM, Electro Dynamic
1—90 HP, 470/940 RPM, General Electric.
1—75 HP, 525/1575 RPM, Electro Dynamic.
1—75 HP, 235/950 RPM, Burke.
1—60 HP, 600/1200 RPM, General Electric.
1—30 HP, 225/900 RPM, Crocker Wheeler.
1—20 HP, 750/1500 RPM, General Electric.
1—5 HP, 600/1200 RPM, General Electric.
6—5 HP, 400/1200 RPM, Westinghouse.
1—5 HP, 225/900 RPM, Electro Dynamic.
1—5 HP, 600/1800 RPM, General Electric.





15,000 KVA Allis Chalmers, 3 phase 27,000 to 4000 V.

TRANSFORMERS

1—15,000 KVA, Pitts., 3 ph., 26,000/4150 v.
4—833 KVA, Allis Chal., 25 cy., 13,200/440 v.
2—400 KVA, G.E., 4156-240/480 v., Scott taps.
3—300 KVA, Pittsburgh, 7800/440 volts.
4—200 KVA, Pittsburgh, 7800-110/220 volts
3—150 KVA, G.E., 33,000-2300/4000 Y
3—150 KVA, Pittsburgh, 6600/440 volts.
12—150 KVA, G.E., 3 ph., 4150-120/208 v.
3—125 KVA, General Electric, 2300/480.
3—100 KVA, Westinghouse, 13200 250 volts
3—100 KVA, G.E., 2400-240/480 volts.
1—75 KVA, Pittsburgh, 7600-110/220 volts.
3—50 KVA, Wagner, 4150-220 volts.
3—50 KVA, Westinghouse, 2200-220/110 volts.
4—50 KVA, Westg., air cooled, 440-220/220-110 v.
3—50 KVA, Westinghouse, 220-110/220 volts.
3—50 KVA, G.E., 2200-110/220 volts.
52—37½ KVA, 2200-220/110 v.
10—25 KVA, Westg., air cooled, 440/220-110 v.
3—25 KVA, Moloney, 2200-220/110 volts.
1—25 KVA, G.E., 220/110-220/110 volts.
2—15 KVA, G.E., 2300-115/230 volts.
1—15 KVA, G.E., 440/110-220 volts.
12—15 KVA, Westg., air cooled, 440/220-220-110 v.
4—10 KVA, G. E., 2300-115/230 volts.
3—7½ KVA, G.E., 440-110/220 volts.

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2—3000 amp., 15,000 v., 3 pole, G.E., type FK-130.
1—3000 amp., 600 v., 4 pole, G.E., type FK-24.
2—2000 amp., 15,000 v., 3 pole, G.E., type FK-53b.
1—1600 amp., 7500 v., 4 pole, Westg., B-2.
1—1500 amp., 440 v., 3 pole, Condit, D12.
1—1200 amp., 15000 v., 4 pole, Westg., B-2.
Also complete stock of small sizes.

ALTERNATORS

1—625 KVA, 450 RPM, 600 volt, Westg.
1—625 KVA, 3600 RPM, 600 volt, G.E.
1—400 KVA, 400 RPM, 240 volt, Westg.
1—375 KVA, 200 RPM, 240 volt, Elec. Mach.
1—250 KVA, 720 RPM, 230 volt, G.E.
1—200 KVA, 3600 RPM, 240 volt, Allis Chal.
1—100 KVA, 1200 RPM, 440 volt, G.E.
1—37½ KVA, 1200 RPM, 2400 volt, Westg.
1—15 KVA, 1800 RPM, 120 volts, G.E.

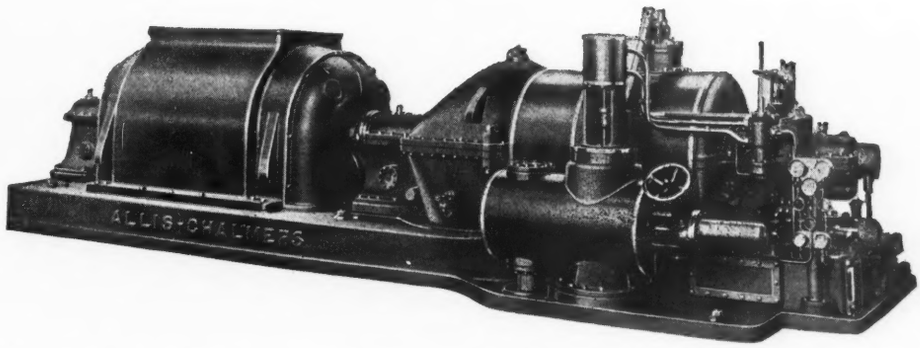
J. L. HEMPHILL & CO., INC., Power Equipment

New York Phone: LOngacre 5-3227 — 1602 53rd ST., NORTH BERGEN, N. J. — New Jersey Phone: UNion 3-2600

DEPENDABLE

Turbo-Generators

It is the Practice of this Company to Confine its Inventory Strictly to Comparatively Modern, Little Used Turbines Some Are Practically New



2—Allis-Chalmers, 2500-KVA, 3/60/2300-volt, 200#-P, 500°F-TT, Surface Condensers

PART OF OUR INVENTORY—BELOW

1—G.E., 7500-KVA, 3/60/600-2300-v, 250# 575° Maximum. Surface Condenser.

1—Allis-Chalmers 4000-KVA, 3/60/2300-v, 200#, 500°-F, TT, Condensing.

1—G.E., 1875-KVA, 3/60/480-v, 200#, 500°, Condensing.

1—G.E., 1563-KVA, 3/60/2300-v, 175#, 100° SH, 28". Surface Condenser.

1—Westinghouse, 1563 KVA, 3/60/2400 volts, 200#, 100° SH. Condensing, Modern.

1—Westinghouse 1000-KW, 250-volt, Direct Current, Condensing, 150/200# pressure. Surface Condenser.

1—Allis-Chalmers 1250-KVA, 3/60/2300-v, 200#, 500° TT. Surface Condenser.

1—G.E., 1250-KVA, 3/60/480-v, 175#-P and 16# Abso. Mixed Pressure.

1—G.E., 937-KVA, 3/60/2300-v, 200#, 500°-TT, 3-Stage Condensing.

1—Allis-Chalmers, 937-KVA, 3/60/2300-v, 200#, 500°-TT, Condensing Surface Condenser.

1—G.E., 625-KVA, 3/60/2300-v, 200#, 500°TT. Condensing.

1—G.E., 625-KVA, 3/60/600-v, 250#, 550°F-TT, Condensing Modern.

WILMS, WEAVER & CO. Union Guardian Bldg. DETROIT, MICH.

We Deal in Turbo-Generators Exclusively

THE PICK OF POWER EQUIPMENT

TURBO UNITS—60 Cy.
1—4000 KVA Allis Chalmers Cond.
1—3125 KVA General Electric Cond.
1—2850 KVA Westinghouse Cond.
1—2500 KVA General Electric Cond.
1—1250 KVA General Electric Cond.
1— 937 KVA General Electric Cond.
1— 750 KVA Terry Double Extr. Cond.
1— 375 KVA General Electric Cond.
1— 250 KVA General Electric Cond.
1— 938 KVA West. 375# I.P. 100# B.P. N-C
1— 375 KVA General Electric Non-C.
1— 312 KVA Moore Non-Condensing
1— 125 KVA Westinghouse Non-C.

STEAM ENGINE UNITS—60 Cy.
1—1067 KVA Nordberg Uniflow
2— 937 KVA Nordberg Uniflow
1— 500 KVA Rice & Sargent Corliss
1— 375 KVA Erie City Slide Valve
1— 325 KVA Skinner Uniflow
1— 300 KVA Hamilton 4-valve
1— 250 KVA Harrisburg Uniflow
1— 250 KVA Erie City Slide Valve
1— 150 KVA Hamilton Poppet Valve

DC STEAM ENGINE UNITS
1—500 KW Skinner Uniflow 250 V.
1—350 KW Ridgway 4-Valve 250 V.
1—300 KW Skinner Uniflow 250 V.
1—300 KW Erie City 4-Valve 250 V.
1—250 KW Skinner Uniflow 250 V.
1—200 KW Chuse 4-Valve 250 V.
1—200 KW Skinner Uniflow 250 V.
1—150 KW Erie Ball 4-Valve 250 V.
1—150 KW Ames Uniflow 125 V.
1—100 KW Ames Uniflow 120 V.
1— 75 KW Skinner Uniflow 250 V.
1— 50 KW Ames Uniflow 125/250 V. 3-wire

OIL & GAS ENGINE UNITS—60 Cy.
1—603 KVA Fair.-Morse 480 V.
1—400 KW West. (gas) 440 V.
1—375 KVA Ing.-Rand 2300/440/220 V.
1—237 KVA Fair.-Morse 480 V.
1—100 KVA Buckeye 240/480 V.
1— 93.5 KVA Anderson 2300 V.
1— 75 KVA Fair.-Morse 2300 V.
1— 40 KVA Fair.-Morse 2300 V.

WATER TUBE BOILERS
6—600 HP Stirling 180-lb. Stokers
2—520 HP Heine 200-lb. Hand Fired
1—500 HP B. & W. 200-lb. Stoker
2—490 HP Stirling 200-lb.
2—407 HP Erie City 250-lb. Stokers
1—400 HP Stirling 200-lb.
2—360 HP Erie City 160-lb. Pulverized Coal
2—357 HP Casey-Hedges 175-lb. Stokers
2—282 HP Edge Moor 200-lb. Stokers
2—160 HP Stirling 155-lb. Hand Fired

SYNCHRONOUS MOTORS—60 Cy.
2—800 HP Electric Machy. 6600 V. 450 RPM
1—175 HP General Electric 440 V. 400 RPM
1—175 HP General Electric 230 V. 225 RPM
1—150 HP General Electric 440 V. 164 RPM
2—120 HP General Electric 440 V. 400 RPM
1—100 HP General Electric 4000 V. 900 RPM

INDUCTION MOTORS—60 Cy.
2—400 HP G. E. slip ring 3800 V. 1800 RPM
1—350 HP G. E. sq. cage 4000 V. 900 RPM
2—300 HP G. E. sq. cage 440 V. 600 RPM
2—250 HP G. E. sq. cage 4000 V. 1200 RPM
5—150 HP West. sq. cage 440 V. 900 RPM

AIR COMPRESSORS
1—3500 Ft. 100-lb. Ing. PRE2, 60 cy. motor
1—3300 Ft. 100-lb. Ing. PRE2, 60 cy. motor
1—2600 Ft. 100-lb. Ing. PRE2, 60 cy. motor
1—2100 Ft. 65-lb. Worth. 60 cy. motor
1—1300 Ft. 100-lb. Sul. Diesel
1—1200 Ft. 100-lb. Ing. 2-stage, belt driven
1—1051 Ft. 100-lb. Sul. WN32, 60 cy. motor
2— 600 Ft. 100-lb. Ing. POC2, Diesel

OIL CIRCUIT BREAKERS
1— 800 A. 87 KV Am.Br.Bov. AF22 Outdoor
2— 600 A. 73 KV West. G222AS Outdoor
1— 400 A. 73 KV G. E. FKO36 Outdoor
4— 400 A. 34.5 KV Condit D-16-A Outdoor
2—1000 A. 30 KV Kelman CB-76 Outdoor
2— 600 A. 30 KV Kelman CB-76 Outdoor
1— 400 A. 25 KV G. E. FKO136 Outdoor
2— 600 A. 15 KV Kelman CB-76 Outdoor
1— 400 A. 15 KV G. E. FKO37 Outdoor

FREQUENCY CHANGERS
2—3125 KVA West. 25/62½ cy. 750 RPM
1—3000 KVA West. 60/25 cy. 300 RPM
1—2500 KVA West. 25/60 cy. 300 RPM
1—1500 KW G. E. 25/60 cy. 300 RPM
1—1250 KVA G. E. 25/62½ cy. 375 RPM
1—1000 KVA G. E. 60/25 cy. 514 RPM
2— 750 KVA G. E. 25/60 cy. 300 RPM
1— 500 KVA G. E. 25/60 cy. 300 RPM

ROTARY CONVERTERS—60 Cy.
2—1000 KW General Electric, 600 V.
1— 500 KW General Electric, 250 V.
1— 500 KW General Electric, 600 V.
2— 300 KW General Electric, 600 V.

SYNCHRONOUS CONDENSERS
1—4000 KVA G. E. 13200 V. 514 RPM
1—2000 KVA G. E. 11000/2200 V. 720 RPM
1—2000 KVA C. W. 11000 V. 600 RPM
1—1000 KVA G. E. 2300 V. 900 RPM
1— 500 KVA West. 2200 V. 900 RPM

TRANSFORMERS—1 Ph. 60 Cy.
3— 600 KVA West. 120,000/2300 V.
1— 5000 KVA Allis 72000/6600 V. 3 ph.
2— 1000 KVA West. 66000/2300 V.
3— 1000 KVA Wagner 33000/2300 V.
3— 500 KVA Allis 33000/480 V.
2— 1000 KVA G. E. 23000-11500/575 V.
3— 100 KVA G. E. 22000/6900 V.
3— 100 KVA Allis 22000/440 V.
1—10000 KVA Pitts. 13200/4600 V. 3 ph.
2— 5000 KVA American 13800/2300 V.
5— 1000 KVA G. E. 13800/2300 V.
1— 450 KVA G. E. 13200/240-480 V. 3 ph.
3— 150 KVA Pitts. 13800/230-460 V.
3— 75 KVA West. 13800/230-460 V.
3— 1000 KVA Packard 11000/2300-4000 V.
3— 150 KVA Pitts. 11000/2400 V.
3— 100 KVA West. 11000/250-125 V.
1— 3300 KVA G. E. 6600/110 V. 3 ph. Furnace
3— 1250 KVA G. E. 6600/550 V.
1— 1500 KVA West. 6600/106 V. 3 ph. Furnace
3— 100 KVA G. E. 6900/440-220 V.
3— 833 KVA Penn. 4800/120-240 V.
3— 1000 KVA Pitts. 2300-4600/550 V.
4— 150 KVA G. E. 2300/115-230 V.
6— 50 KVA G. E. 2400/240-120 V.

PARTIAL LIST—WE HAVE ALL CLASSES OF POWER EQUIPMENT

BREW, WOLTMAN & Co., INC.

50 CHURCH STREET, NEW YORK CITY

SUCCESSFUL OPERATION GUARANTEED

Every Machine in This Ad is Owned Outright By Us

D C MOTORS

230 Volt—Constant Speed

	HP	Make	Type	Speed
1—	300	Cr. Wh.	CCM-108H	550
1—	250	Al. Ch.		525
2—	200	Whse.	SK	400
1—	200	G.E.	DMC	475
1—	150	G.E.	MPC	275
1—	140	G.E.	MDS-108	410
1—	125	G.E.	CDP-123	1750
3—	100	G.E.	LC-50	1200
1—	100	G.E.	RC-38	600

230 Volt—Adjustable Speed

1—	600	Whse.		150/275
1—	300	G.E.	MPC	250/400
1—	300	G.E.	MPC	275/550
2—	275	G.E.	DMC	500/750
1—	200	Whse.		400/500
1—	150	G.E.	MPC	250/450
1—	100	Al.Ch.		950/1150
1—	75	Whse.	SK	475/900
1—	75	G.E.	CD-145	575/865
1—	75	Cr.Wh.	65H	600/1200
1—	75	G.E.	C	500/1000
2—	60	El.Dy.	S	525/1050
2—	50	Cr.Wh.	CMC-81H	300/900
1—	45	G.E.	CD-125	450/1350
24—	30	Whse.	SA	500/1500
1—	25	Cr.Wh.	50H	335/1000

TRANSFORMERS

	KVA	Make	PH	Type	Voltages
1—	1500	Whse.	3	OISC	26400/13200x460
3—	1000	G.E.	1	HKDD	13800x2300
1—	333	Pitts.	1	OISC	13800x440/220
3—	300	G.E.	1	H	13200x2300/575
3—	300	Pkd.	1	OISC	2300x460
2—	200	Whse.	1	SK	6900x230/460
3—	200	G.E.	1	H	26400x115/460
3—	100	Whse.	1	OISC	13200x250

ENGINE GENERATOR SET

1—100 KW, Whse. D.C. Gen. 125/250 v. 3 wire 250 R.P.M. dir. Conn. 150 H.P., 14x15 Skinner steam engine 150# press

MOTOR GENERATOR SETS

3 phase—60 cycles

1—1500 KW Whse. 250 V. Gen. d.c. to 2100 HP 2200/4400 V. syn. motor.
1—1500 KW G.E. 600 v. Gen. d.c. to 2100 HP 6600 v. syn. motor.
1—500 KW G.E. 600 v. Gen. d.c. to 700 HP 13200 v. syn. motor.
1—500 KW G.E. 600 v. Gen. d.c. to 700 HP 2300 v. syn. motor
1—200 KW Al. Ch. 3 units; 2—100 KW 250 v., Gen. d.c. to 220 KVA 2200 v. syn. motor.
1—150 KW, G.E., 550 V., Gen. d.c. to 225 H.P., 2200 V. syn. motor.
1—125 KW, G.E., 275 V., Gen. d.c. to 190 H.P., 2200 V., syn. motor.

TURBO GENERATOR SET

1—500 KW, Whse., 625 KVA, 480 v., 3 ph., 60 cy. generator with Curtis single stage 160/125 pound non-condensing turbine good for 5 to 10 pounds back pressure
1—500 KW, G.E., 625 KVA, 2300 v., 3 ph., 60 cy. generator with Curtis 4 stage, 150 pound condensing turbine complete with condenser, etc.

ROTARY CONVERTERS

60 Cycle

2—1500 KW, Whse. 720 RPM 650 v. DC with 3-single phase, 33000 v. transformers and panel.
1—1500 KW Whse 720 RPM 600 v. DC with 1- three phase 11500 v. transformers and panels
2—1000 KW whse. 900 RPM 650 v. DC with 3- single phase 11800 v. transformers and panels.
2—1000 KW, G.E. HCC 900 RPM 600 v. DC with 1-three phase, 11000 v. transformer and panels
1—750 KW Whse 720 RPM 250 v. DC with three phase 6600/2300 v. transformer and panels.
1—500 KW, Westinghouse, 900 RPM, 125/250 volt, DC, with 3- single phase, 60 cycle, 13200/6600/2300 volt transformers and panels
1—300 KW, G.E., type HCC, 1200 RPM., D.C., 600 V, AC, 6 ph., 1200 RPM.

A C MOTORS

3 phase—60 cycle

Synchronous

	HP	Make	Type	Volts	Speed
1—	500	G.E.	TS	440	360
1—	350	Cr.Wh.	301	2200	600
1—	300	G.E.	ATI	440	600
1—	300	G.E.	ATI	2300	600
1—	250	G.E.	ATI	220	450
1—	200	Whse.		440	514
3—	150	G.E.	TRB	220x440	450
1—	150	Whse.		2200/550	1800
1—	100	Whse.		2200/550	1800
1—	100	Whse.	HP	220	300
1—	100	Whse.	G	2300	900

Slip Ring

1—	1000	G.E.	IM	2200	720
1—	600	G.E.	IM	2200	900
1—	600	Al.Ch.	ANY	2200	1180
1—	450	Whse.	CW	2200	875
1—	400	G.E.	MT	550/440	300
1—	400	Al.Ch.		2300	505
1—	300	G.E.	IM	2300	585
1—	250	G.E.	MT-410	2300	400
1—	250	Whse.	CW	440	585
1—	250	G.E.	MT	4000/2300	257
2—	200	Whse.	CW	2200	514
1—	200	G.E.	IM	440	435
2—	175	G.E.	IE-15A	2200	880
1—	150	G.E.	IM	2200	695

Squirrel Cage

1—	500	G.E.	1-17B	2200	690
1—	400	G.E.	KT	2300	585
1—	300	Whse.	CS	550	580
2—	300	G.E.	IK	2300	600
1—	300	Al.Ch.		2200	1160
1—	250	Al.Ch.		220/440	1150
1—	200	Whse.	CS	440	580
1—	200	Whse.	CS	550	720
1—	200	Al.Ch.		2200	1750
1—	150	G.E.	IK	2200/440	900
3—	150	Al.Ch.	AN	220/440	1750

RE-NU-BILT BELYEA MOTORS

What are your requirements? units up to 5000 kw available in stock.

BELYEA COMPANY INC.

Main Office & Shop: 43 HOWELL ST., JERSEY CITY, N. J.

POWER PLANT MACHINERY

Available Immediate Delivery

TURBINE-GENERATOR UNITS

3 phase, 60 cycle

6250 KVA Westinghouse condensing 175-200 lb. pressure, 2300 volts, complete with surface condenser and auxiliaries.

1875 KVA G.E. condensing 225 lb. pressure, 600° T.T. 2300 volts, 3600 RPM, complete with condenser.

1563 KVA G.E. condensing 175-200 lb. pressure, 500° T.T., 2300 volts, 3600 RPM, complete with surface condenser and condensing auxiliaries.

1250 KVA ALLIS condensing 150-200 lb. pressure, 100° superheat, 2300 volts, 3600 RPM, complete with Wheeler surface condenser.

937 KVA G.E. condensing 200 lb. pressure, 100° SH, 2300 volts, 3600 RPM complete with Ingersoll-Rand condenser, exciter, switchboard and instruments.

937 KVA Westinghouse automatic extraction condensing, 150-200 lb. pressure, 10 lb. bleeder, 480 volts, 3600 RPM, complete with direct connected exciter and switchboard.

937 KVA ALLIS condensing 200 lb. pressure, 100° SH, 2300-550-480 volts, 3600 RPM complete surface condenser with auxiliaries, direct connected exciter—Modern and practically new.

937 KVA ALLIS condensing 150 to 200 lb. pressure, 475° TT, 2300 volts, 3600 RPM, complete with direct connected exciter, surface condenser and auxiliaries.

750 KVA G.E. condensing, 150-200 lb. pressure, 2300 volts, 3600 RPM, complete surface condenser and exciter set.

625 KVA G.E. condensing 200 lb. pressure, 2300 volts, 3600 RPM, complete with condenser and auxiliaries.

375 KVA G.E. condensing 150-200 lb. pressure, 100° superheat, 2300 volts, 3600 RPM, complete with surface condenser auxiliaries.

112 KVA Allis-Chalmers non-condensing, 125-150 lb. pressure, 5 lb. back pressure, 480 volts, 3600 RPM, complete direct connected exciter and rheostats.

MOTOR GENERATOR SETS

1500 KW ALLIS 600 volt direct current generator direct connected to a 2190 HP, 3 phase, 60 cycle, 4000 volt, 300 RPM synchronous motor.

750 KW G.E. 550 or 275 volt, direct current generator direct connected 1075 HP 90% P.F., 3 phase, 60 cycle, 4000 volt, 514 RPM synchronous motor.

20 KW G.E. 125 volts direct current generator direct connected 25 HP, 3 phase, 60 cycle, 220 volts, 1200 RPM motor.

ENGINE-GENERATOR UNITS

3 phase, 60 cycle—Alternating Current

1125 KVA G.E. 480 volts, 150 RPM direct connected 24"x46"x33" Erie-Ball cross compound engine, complete exciter, and rheostats.

1000 KVA G.E. 480 volts, 150 RPM direct connected 31"x36" Skinner Unaflow engine, complete exciter, switchboard panel and instruments.

500 KVA G.E., 240/480 volts, 150 RPM direct connected 26"x32" Skinner Universal Unaflow non-condensing engine, 130-160 lb., 6 lb. back pressure, complete exciter and rheostats.

500 KVA G.E. 240 volts, 120 RPM direct connected 20"x42" Rice Sargent Corliss non-condensing engine, 125-150 lb., 10 lb. back pressure.

100 KVA WESTINGHOUSE, 240 volts, 277 RPM direct connected 14"x14" Ames Unaflow engine, 125-150 lb. pressure, 5 lb. back pressure.

ENGINE-GENERATOR UNITS

Direct Current

1500 KW WESTINGHOUSE 250 volts, 360 RPM generator direct connected by reduction gear to a Westinghouse condensing turbo generator unit complete with auxiliaries.

500 KW G.E. 250 volts, 150 RPM direct connected 26"x36" Skinner Universal Unaflow non-condensing engine.

300 KW WESTINGHOUSE 250 volts, 175 RPM direct connected 24"x26" Skinner Unaflow non-condensing engine, 110-150 lb. pressure, 5 lb. back pressure, complete switchboard and instruments.

250 KW (2) Westinghouse 1000 amperes, 250 volts, 200 RPM direct connected 23"x24" Ames Unaflow engine, 125-150 lb. pressure, complete switchboard and instruments.

200 KW G.E., 125 volt, 200 RPM direct connected 18"x24" Erie Ball non-condensing engine, 135-150 lb. pressure.

MOTORS

3 phase, 60 cycle

875 HP, WESTGH. 440 V., 240 RPM synchronous.

620 HP G.E. type ATI, form S, 440 volt, 164 RPM synchronous.

400 HP, G.E. type TS, Form AL, 440 V. 300 RPM synchronous.

400 HP, WESTINGHOUSE type CW, 440 V., 500 RPM, slip ring.

300 HP, 80% P.F. WESTINGHOUSE 2300 V., 200 RPM synchronous.

250 HP, ALLIS-CHALMERS 440 V., 600 RPM synchronous.

200 HP, G.E. 2200 volt, 435 RPM slip ring.

150 HP (7) G.E. 2200 volts, 300 RPM slip ring.

125 HP, (3) 80% P.F. Elec. Mchy. 440 V., 400 RPM synchronous with starting equipment.

125 HP, 80% P.F. Elec. Mchy. 440 V., 514 RPM synchronous.

100 HP G.E. 2200 volts, 900 RPM slip ring.

50 HP, type I, form M, 3 phase, 60 cycle, 2200 volts, 1200 RPM slip ring.

50 HP, (2) G.E. form K, 220 V., 900 RPM squirrel cage.

MISCELLANEOUS

1 WESTINGHOUSE frequency changer set consisting of a 655 HP, 3 phase, 25 cycle, 2200 volt, 300 RPM synchronous motor direct connected to 565 KVA 80% P.F., 3 phase, 60 cycle, 240 volt alternating current generator complete and equipped with direct connected exciters, all panels with instruments—practically new.

250 KW CROCKER-WHEELER 250 volt, 600 RPM compound wound interpole direct current generator.

1500 KVA, 3 phase, 60 cycle, 22,000 volt primary, 2300 volt secondary WESTINGHOUSE transformer.

900 KW G.E. 3 phase, 60 cycle, 480 volt, 150 RPM alternating current generator with exciter.

500 KVA IDEAL, 3 phase, 60 cycle, 240 volts, 400 RPM, three-bearing belted type generator with direct connected exciter and rheostats.

312 KVA WESTINGHOUSE, 3 phase, 60 cycle, 2300 or 220 volts, 200 RPM, engine type generator with belt driven exciter and rheostats.

200 KVA WESTINGHOUSE, 3 phase, 60 cycle, 240 volts, 200 RPM engine type generator with rheostat.

1 ELLIOTT EHRHART jet condenser with all auxiliaries suitable for operation with a 5000 KW turbine-generator unit.

1500 sq. ft. WESTINGHOUSE surface condenser.

1055 cubic feet, 100 lb. air pressure CHICAGO PNEUMATIC horizontal compressor direct connected to 170 HP, 240 V., 150 RPM General Electric direct current motor.

SPECIAL

800 HP G.E. 90% leading Power Factor, 3 phase, 60 cycle, 440 volt, 932 amperes, 124 RPM, type TSR, form AL, Super-Synchronous motor complete with panels and starting control equipment. Modern and Practically new.

Utilities Electrical Machinery Corporation
600 NATIONAL CITY BANK BLDG.
CLEVELAND, OHIO
WIRE OR PHONE
LONG DISTANCE 422

Get what you want IN A HURRY

from L. J. LAND & COMPANY, New York's Largest Stock of Electrical Equipment

A.C. EQUIPMENT

SYNCH. MOTORS

200 H.P. G.E. TS 514 RPM
90 H.P. Westinghouse 900 RPM
50 H.P. Elec. Mchy. 1200 RPM
47 H.P. West. 1200 RPM .7 PF

SLIPRING MOTORS

300 H.P. General Electric 720 RPM
200 H.P. General Electric 514 RPM
150 H.P. Allis Chalmers 720 RPM
2—125 H.P. G.E. 720 RPM
112 H.P. G.E. hoist 720 RPM
100 H.P. Fairbanks Morse 720 RPM
100 H.P. Allis Chalmers 720 RPM
100 H.P. Westinghouse 720 RPM
75 H.P. Westinghouse 1200 RPM
75 H.P. Allis Chalmers 600 RPM
60 H.P. Westinghouse 1200 RPM
60 H.P. General Electric 1200 RPM
60 H.P. General Electric 900 RPM
6 H.P. Westinghouse 300 RPM
4 H.P. GE. MT 900 RPM

SQUIRREL CAGE MOTORS

200 H.P. Allis Chalmers 1800 RPM
200 H.P. Allis Chalmers 1200 RPM
200 H.P. General Electric 600 RPM
150 H.P. Westinghouse 1800 RPM
100 H.P. General Electric 900 RPM
75 H.P. Westinghouse 900 RPM

A.C. GENERATORS

200 K.W. General Electric 600 RPM
125 KVA G.E. 900 RPM
100 KVA Crocker Wheeler 900 RPM
100 KVA Elec. Machy. 1200 RPM
75 KVA G.E. 1200 RPM
90 KW GE 900 RPM
30 KW G.E. 1200 RPM
15, 20, & 25 KVA 1200 RPM (8)

LOW & HIGH VOLT. GEN.

200 K.W. Wghse. 600 V. Mtr. Gen Set
2 to 40 K.W. 600 to 2000 V. M.G. Sets (11)
24 K.W. 60 V. General Electric
1 to 75 K.W. 10 to 80 V. (15)
12½ x 12, 390' Amer. Air Comp.

200 K.W. Elect. Machy. Syn.
MOTOR GENERATOR SET
Motor: 300 H.P., 3 ph. 60 cy., 4000 V, 900 R.P.M.
Gen.: 200 KW, 250 V, 900 R.P.M. Complete A.C. and D.C. Control Equipment.

150 K.W. Westinghouse Syn.
MOTOR GENERATOR SET
Motor—260 H.P., 3 ph., 60 cy., 220 V, 1200 R.P.M.
Gen.—150 KW, 125 V, 1200 R.P.M. Complete A.C. and D.C. Equipment.

100 KW Westinghouse Syn.
MOTOR GENERATOR SET
Motor: 150 H.P. 3 ph. 60 c. 440 V 1200 RPM
Gen. 100 KW 250 Volt 1200 RPM—Complete AC & DC Control Equipment

14 x 10 Ingersoll Rand Air Comp.
1 Ton Shepard
15 to 50 K.W. Frequency Changers 90, 100, 120 cycle (7)
5 H.P. B & D D.C. Buffer
Fans & Blowers (19)
Tirrell Voltage Regulators
165 KVA Arc Furnace Transformers

ONLY PARTIAL LISTING
New York City's Largest Stock Electrical Equipment
ONE YEAR GUARANTEE

L. J. LAND AND CO.

146 Grand Street—Canal 6-3923—New York, N.Y.
Reading, Penna. Office: 10th and Exeter St.
Over Quarter Century Serving Industry

D.C. EQUIPMENT

230 V. D.C. MOTOR GEN. SETS

100 K.W. West. 1200 RPM
75 K.W. Elect. Machy. 1200 RPM
50 K.W. Burke 1200 RPM
45 K.W. Westinghouse 700 RPM

125 V. M.G. SETS

150 K.W. Westingh. Syn. Motor
75 K.W. Westingh. Syn. Motor
40 K.W. Westinghouse
25 K.W. Gen. Elec.

230 V. D.C. MOTORS

75 H.P. General Electric 850 RPM
60 H.P. Sprague 900 RPM
60 H.P. G.E. 1000 RPM
60 H.P. Roth 600 RPM
50 H.P. G.E. 850 RPM
40 H.P. Reliance 625 RPM

230 V. VAR. SPEED MTR.

100 H.P. Crock. Wh. 550/900 RPM
75 H.P. Electro Dyn. 700/1050 RPM
50 H.P. West. 400/1200 RPM
50 H.P. West. 525/1050 RPM
35 H.P. West. 500/1500 RPM
30 H.P. West. 500/1500 RPM
30 H.P. G.E. 825/2000 RPM
25 H.P. G.E. CD 600/1200 RPM
15 H.P. G.E. RF 400/1200 RPM
15 H.P. West. .825/1650 RPM
15 H.P. G.E. 600/1800 RPM
15 H.P. Electro Dyn. 450/1350 RPM

115 VOLT D.C. MOTORS

90 H.P. General Electric 900 RPM
25 H.P. West. 600 RPM
15 H.P. Eck 1500/1800 RPM
10 H.P. West. 1750 RPM

MOTORS FOR DELIVERY NOW

SLIP RING MOTORS
2200 Volt, 60 Cycle, 3 Phase

Quan.	Hp.	Make	Type	Speed
1	50	G.E.	MT-346	900
3	150	G.E.	I-M	600
4	200	G.E.	I-M-17	600
1	440	G.E.	I-P	257
1	450	G.E.	I-M	1800

60 Cycle, 3 Phase

Quan.	Hp.	Make	Type	Volt-	Speed
1	30	G.E.	MT 300	220	1200
1	30	West.	CW 574A	220	1200
2	40	G.E.	MT 300	220	1200
1	40	G.E.	MT 536	220	900
1	50	G.E.	MT 346	440	900
1	50	G.E.	MT 542	440	900
2	50	G.E.	MT 352	440	720
1	50	West.	CW 578A	440	600
1	50	G.E.	I-M	440	514
1	75	G.E.	Mt 347	440	1200
1	100	G.E.	I-M	220	1800
1	100	West.	CW-762C	440	1200
1	100	G.E.	I-M	440	720
1	125	West.	CW	440	900
1	150	G.E.	I-M	440	600

SQUIRREL CAGE MOTORS
25 Cycle, 3 Phase

2	100	G.E.	I-K	440	750
1	100	G.E.	I-K	2200	1500
1	100	G.E.	KT 553	2200	1500
1	150	G.E.	I-K	440	1500
4	150	G.E.	I-K	440	750
1	200	G.E.	I-K	440	500
2	300	G.E.	I-K	440	1500

MOTORS
****LARGE SQUIRREL CAGE ONLY**
60 Cycle, 3 Phase

Hp.	Make	Type	Volt-	Speed
50	G.E.	I-K	220	514
60	G.E.	KT 333	440	1800
60	G.E.	KT 346	440	900
60	G.E.	KT 343	2200	1200
75	L. Allis	T.E.F.C.	550	3600
75	G.E.	KT 337	440	1800
75	West.	CS 766A	440	900
75	G.E.	KT 552	440	900
75	G.E.	KT 352	2200	900
100	G.E.	KT 543	440	1800
100	G.E.	KT 556	440	900
100	G.E.	I-K	440	720
100	G.E.	KT 558	550	720
125	G.E.	KT 500	440	900
135	G.E.	I-K	2200	1200
150	G.E.	KT 558	440	900
200	G.E.	I-K	440	600
150	G.E.	KQ 549	440	1800
150	G.E.	I-K	2200	600

Remember the above is a partial listing of Squirrel Cage motors. We have several hundred in smaller sizes. Wire or write for prices.

SPECIAL ITEMS AT BARGAIN PRICES

1—20 KW Westinghouse SK-110 L, Motor generator set, factory built, 125 volt, DC 1200 rpm. motor 30 HP. Westinghouse, 2200 v. 60 cy. 3 ph. 1200 rpm. on base, bare. Price.....
1—24 KW, G. E. Rc31, 60 volts, flat compound, DC generator. 1800 rpm. on base, 400 Amp. driven by 40 HP. G.E. RC 31, DC 230 v. 1800 rpm. on base 3 bearing.
1—25 KW, General Electric Factory Built Motor Generator Set, type DLC, compound interpole, 250 v. DC 1200 rpm. 3 bearing, motor 40 HP. G.E., I-K, 550 v. 60 cy. 3 ph. 1200 rpm. on base bare. Price.....
Will change AC voltage on stator for $100.00 additional.
1—45 KW as above. Price.....
1—600 KVA, General Electric ATI, synchronous condenser form B 550 v. 30 cy. 600 rpm. 3 ph. direct connected exciter with amortisseur winding, electrically OK. Price.....
1—30 KW, Allis-Chalmers, Type E, Motor Generator set, Late, 125 v. DC 3 bearing 1800 rpm. compound interpole on base, factory built, motor, 35 HP. 75 Amps. 500 v. DC 1800 rpm. bare. Price.....
1—75 KW. Ridgeway Motor generator set, factory built #3830, 125 v. 600 Amp. 1200 rpm. compound interpole, on base motor 110 HP. Ridgeway slip-ring #1378, 2300/60/3/1200 good commutator. Very clean set with controls. Price .....
1—70 KVA West. Sealed sleeve, 6 million serial, Motor Generator Set, 3 bearing, 1 phase, 60 cy. 220 v. 1200 rpm. AC generator. 7 P.F. with amortisseur winding full stator winding direct connected exciter, single bearing motor, 125 HP. West. CS 2 bearing, 440 v. 60 cy. 3 ph. 1200 rpm. bare. elect. OK. Price .....

SLIP RING MOTORS
25 Cycle, 3 Phase

Hp.	Make	Type	Volt-	Speed
50	G.E.	I-M	440	750
50	Al-Ch.	ANY	440	380
75	West.	CI 756A	440	750
75	G.E.	I-M-15	440	500
100	G.E.	MT 357	440	1500
300	West.	CW	440	500
400	Cr-Wh.	131AQ	2200	500
500	West.	CW	440	375

A C GENERATORS & SYNCHRONOUS MOTORS
60 Cycle

Kva	Volts	Make	Type	Phase	Speed
3	220	Al-Ch.		1	1800
5	220	G.E.		3	1800
7½	220	G.E.	TAB	3	1800
15 HP.	220	Ideal		3	1800
20	2200	Fair-M		3	1806
37	220/440	N.W.		3	3000
37		G.E.	ATB*PB	3	1200
40	220	Al-Ch.		3	1200
50	any	G.E.	ATB*PB	3	1200
60 HP.	550	G.E.	TS 7536	3	1200
30	220	G.E.	TAB	3	1800
60 HP.	220	Burke		2	1200
70/100	220	West.		½	1200
60 HP.	4000	G.E.	ATI	3	900
60 HP.	4000	G.E.	ATI	3	900
100 HP.	4000	G.E.	ATI	3	900
100 HP.	440	Al-Ch.	25 cy.	3	750
125 HP.	220	G.E.	TS	3	900
300	220	G.E.	ATB	3	720
600	550	G.E.	30 cy.	3	900
75	any	West.	Late	3	3600
25	220	G.E.	TAB	3	1800

ELECTRIC EQUIPMENT CO., Rochester, N.Y.

Post Office Box 51 — Main 252—253 — 347 N. Clinton Ave.

TURBOS 60 cy

1—4000 KW GE 7-stage double bucketed 60/3/6600/1800 RPM 150/200# ISP. Surface Condenser, exciter and pasels.
2—3125 KVA Lynn Type GE Rigid Frame 4-stage 60/3/2300/3600 RPM. Surface Condenser equipped. Unique minimum log service.
1—625 KVA Wemco 10-C Parsons or NC 60/3/440/2200/3600—Jet Condenser—Surface available.
1—300 KW Wemco Single Wheel Re-entry 6-/3/240-120/250#.

TURBOS 25 cy

7500 KW GE Curtis Condensing Turbo 25/3/2300/1500 RPM. Surface Condenser.
6250 KW 80% PF Parsons design Multiple Expansion Parallel Flow 25/3/4000/1500 RPM, Surface Condenser equipped.
6000 KW GE Curtis 25/3/6600/1500 RPM, Jet Condenser equipped.
2—7200 KVA Wemco Impulse and Reaction Semi-Double Flow 25/3/11000/1500 RPM. Surface Condenser equipped.
3—4000 KW 80% old rated (log service record 7500 KW) Wemco Impulse and Reaction design 25/3/13200/1500 RPM. Surface Condenser equipped.
2—3500 KW Wemco 25/3/13200/1500 RPM with combined 18000 sq. ft. Surface Condenser.
2500 KW GE Curtis Condensing Turbo 25/3/2300/1500 RPM, Surface Condenser.
2—2000 KW Wemco 25/2/6600/1500 RPM Jet Condenser.

TURBOS DC

1—500 KW GE Mixed Pressure 16 to 140# 250 volts DC. Surface Condenser 3100 sq. ft.

FREQUENCY CHANGERS

5000 KW/7000 KVA Wemco Freque 62½/3/4150/375 RPM: 25/3/13200. Complete with all auxiliaries.

MOTOR GENERATORS

1—1500 KW GE MPC 60/3/4000 to: 600 volts DC.

BOILERS

3—600 HP B&W Vertical Steel Header Longitudinal 3-drum 200# Superheater and Taylor Stokers.
3—500 HP Edgemoor Steel Header Boilers—200#—Foster Superheaters.
3—500 HP B&W Stirling Boilers 200 lb. superheater equipped.
18—500 HP Edgemoor Box Steel Header Water Tube, Superheaters and Chain Grate Stoker.
4—500 HP B&W Sterling 4 Drum, Cross Drum Bent Tube Boilers 160#, Diamond Soot Blowers, Green Chain Grate Stokers.
450, 400, and 300 HP B&W Sterling 4 Drum Water Tube Boilers 160#, Green Chain Grate Stokers, Coal and Ash Handling System—Overhead.
1—418 HP B&W Stirling Boiler 200 lb.
1—484 HP Springfield Horiz. ASME Straight Tube Longitudinal Cross Drum Boilers, 200#.

IMMEDIATE DELIVERY

GUARANTEED REBUILT POWER EQUIPMENT

MOTOR-GENERATOR SETS

500 KW GE 600 v DC 4400/2200 syn.
300 KW GE 3-unit 3-w 2200 v syn AC
300 KW GE 600 v DC 11000/2200 AC
225 KW Ideal 115 v DC 2200 v AC syn.
225 KW Wtg 115 v DC 2200 v AC syn.
150 KW GE 250 v DC 2200/220 syn.
150 KW GE 600 v DC 4000/2300 syn.
150 KW GE 250 v DC 2200/440 syn.
100 KW AC 125 v DC 440 v ind AC
100 KW GE 230 v DC 440 v syn AC
100 KW GE 250 v DC 2200 v ind AC
90 KW GE 250 v DC 220 ind AC
75 KW GE 125 v DC 220 syn AC
75 KW GE 125 v DC 220/440 ind AC
75 KW GE 125 v DC 220 v AC ind.
90 HP Wtg. 110 v DC 2200 AC gen
50 KW AC 125 v DC 2200 v ind AC
50 KW GE 125 v DC 4000/2200 ind AC
50 KW AC 125 v DC ind AC
33 KW Diehl 110 v DC 220 syn AC

SLIPRING MOTORS

HP	Make	Type	Volts	Speed
2850	Wtg.	CW	6600	450
1500	Allis. Chal.	ANY	2200	485
800	Wtg.	CWI	6600	443
700	Allis. Chal.		440	354
600	G.E. (2)	IM	2300	770
500	G.E. (2)	IM	2200	600
350	G.E.	IM	2200	360
350	G.E.	MT	2300	300
300	G.E.	IM	440	300
300	Allis Chal.		2300	300
300	G.E.	MT	2200	514
200	G.E.	MT	440	870
200	G.E. (2)	IL	440	600
225	G.E.	IM	440	600
200	Howell R. brg.		440	600
200	G.E.	IM	2200	600
200	Wtg.	CW	440	580
200	Wtg.	CW	440	345
150	Wagner	BR	440	1150
150	Al. Ch.	ANY	440	870
150	G.E.	MT	440	870
150	G.E.	IM	220	600
150	G.E.	IM	220	585
100	Wtg.	HF	440	230
125	G.E.	MT	440	720
75	Al. Chal.		2200	720
75	G.E.	MT	440	850
75	Allis Chal.	ARY	220	865

SQUIRREL CAGE

200	G.E.	KTP557	2200	1800
200	G.E.	IK	440	580
200	Wtg.	CS	440	580
200	Wtg.	CS	440	580
150	G.E.	IK	2200	1750
150	Wtg.	CS	2300	1175
150	Al. Ch.		440	1170
125	G.E.	IK	200	580
100	Wtg. (2)	CS	440	1160
100	Wtg.	CS	2200	1160
100	G.E.	IK	220	1200
100	G.E.	IK	440	900
75	G.E.	IK	2200	1700
100	Wagner	38T3BM	2200	428
75	G.E. (5)	IK	220	600
60	Allis Chal.	AR	440	3500
60	Wagner	VRB	220	1200
60	G.E.	IK	220	900
60	G.E.	IK	220	900
60	Wtg.	CS	220	435
50	Howell	FBB	220	1725
50	Watson	KH	440	1720
50	G.E.	KT	2200	870
50	G.E.	IK	440	490

SYNCHRONOUS MOTORS

HP	Make	Type	Volts	Speed
1050	GE	ATI	460	900
875	Wtg		440	240
800	Al. Ch.		2300	180
750	Wtg. (2)		4000/2300	1200
650	Al. Ch.		2300	1200
450	Wtg. (2)		4000/2300	1200
400	GE	TS	440/2300	360
225	GE	ATI	240	720
200	Wtg.	HR	2200	225
190	Elec. Mhy (2)		440	720
190	Elec. Mhy (2)		220	514

AC GENERATORS

KVA	Make	Type	Volts	Speed
187	GE	ATB	2300	600
175	Wtg.		2200	900
150	West Elec S15C		230	900
125	Wtg.		2400	900
25	Cr. Wh.		240	1800
10	Cr. Wh.		240	1800
4	GE	1 ph 14½ cy	110	860
1.2 KW	GE	1 ph 14½ cy	110	860

BOILER FEED PUMP
Worthington size 12 x 7½ x 15 300# water press. 175# steam, duplex plunger type.

SPECIAL MOTOR

1—25/65 HP Wtg. oil well type 3/60/440 volts, 570/1160 RPM, style 88C138, with control, real bargain.

SYNCHRONOUS CONDENSERS
3 ph. 60 cy.

1000 HP Wtg. 3/60/440 volts 900 RPM
2000 HP GE ATI 3/60/11000 v. 600 RPM

ENGINES

500 KW GE MPC 250 volts DC generator, with Skinner uniflow engine.
500 HP Winton gas engine 8-cylinder overhead valve type, can furnish with AC generator.
125 hp. Waukesha gas engine, AC Gen.
165 hy. Hope gas engine, AC driven.

ROTARY CONVERTER

200 KW Gen. Elec. 125/250 volts DC 6 phase 60 cycle, 440 volts AC with switchgear and transformer equipment.
500 KW GE 240/275 volts DC 6 phase 60 cycle, 2200/4000Y AC, with switchgear and transformer equipment.

25 Cy. M.G.'s,
75 KW GE 125 v DC 3/25/440 AC 750 RPM interpole.
75 KW GE 125 V. DC 3/25/220 v 750 RPM 2-brg.

FREQUENCY CHANGERS

500 KVA Westinghouse with 583 HP 3/25/2200/575/440/220 v. 750 RPM syn. motor 500 KVA 3/62½ cy. 2300/440/220 syn. gen. both machines amortisseur equipped, can be operated from 60 cy. to furnish 24 cy.

TRANSFORMERS
2—5000 KVA 3/60/OISC 13800 pri 2300 v sec.
3—750 KVA GE 1/60/13890 pri 2200 v sec.
4—250 Wtg. 13800 to 2300/4000 v.
2—100 KVA GE 1/60 4600 to 120/240 v sec.
9—75 KVA Wtg. 1/60 3810 pri 240/122 sec.

WRITE FOR YOUR FREE COPY OF COMPLETE STOCK CATALOG

CHICAGO ELECTRIC CO.

1320 W. 22ND ST.
CHICAGO, ILLINOIS

POWER PLANT EQUIPMENT CO., INC.

39 Cortlandt Street
New York, N. Y.

AC TURBINE UNITS

5000 KVA G.E. 2300/4000 V., Cond.
1250 KVA (2) G.E. 2300/4000 V., with surface Condensor.
937 KVA G.E. 2300/600 V., Non-Cond.
937 KVA G.E. 2300 V., with Surface Condensor.
937 KVA Al. Chal.—Elliott, 480/240 V., cond. or mixed pressure; with Jet Condensor, etc.
780 KVA Al. Chal. 2300 V., with Surface Condensor, Rado-Air Ejectors, etc. NEW, never in service.
625 KVA Wghse, 2300 V., with Surface Condensor, etc.
625 KVA Al. Chal. 2 ph., 2400 V; Jet Condensor, etc.
625 KVA GE. 2300 V.; Bleeder; Condensor.
625 KVA Al. Chal.—Elliott, 240/480 V., Automatic Bleeder, with Jet or Surface Condensor.
625 KVA Wghse. 2400 V., with Jet Condensor, etc.
375 KVA G.E. 2300 V., non-cond.
375 KVA Al Chal. 2 ph., 2400 V., with Jet Condensor.
375 KVA G.E. 2300 V., Bleeder, with Jet Condensor.
312 KVA Ridgeway-Elliot 480/240 V., with Jet Condensor.
150 KVA Wghse. 240/480 V., Jet Condensor.

AC ENGINE UNITS

450 KVA Wghse. 18x36 Filer Stowell Corliss
375 KVA G.E. 22x27 Erie Ball 4 V.
312 KVA Elec. Mchy. 20x24 Chuse Uniflow
312 KVA Wghse. 21x22 Skinner Uniflow
300 KVA G.E. 18x36 Murray Corliss
250 KVA G.E. 18x42 Hewes-Philips Corliss
250 KVA G.E. 17x20 Erie Ball 4 V.
200 KVA G.E. 21x22 Skinner Uniflow
200 KVA Al. Chal. 14x36 Al. Chal. Corliss
125 KVA G.E. 14x15 Skinner Uniflow
112 KVA G.E. 14x18 Erie Ball 4 V.
100 KVA G.E. 14x16 Skinner Uniflow
60 KVA G.E. 12x12 Skinner Uniflow

DIRECT CURRENT UNITS

KW	Gen.	Volts	Engine
1000	Al. Chal.	250	Al. Chal.
500	C.W.	250	Hamilton Unif.
300	G.E.	250	Skinner Unif.
300	Wghse.	250	Murray Corliss
200	Wghse.	250	Turbine
200	G.E.	250	Skinner Unif.
200	G.E.	125	Erie Ball 4 V.
150	C.W.	125	Erie Ball 4 V.
125	G.E.	250/125	Erie Ball 4 V.
100	C.W.	250	Erie Ball 4 V.
100	G.E.	125	Erie Ball 4 V.

BLEEDER TURBINE UNIT

625 KVA Allis Chalmers-Elliott 3 ph. 60 cy. 240/480 v.; automatic bleeder; with jet or surface condensor

BOILERS (ASME)

950 HP Sterling, 270#
728 HP E.C. Vert. 200#
685 HP Sterling 200#; Harrington Chain Grate Stokers
500 HP Murray (Heine) 200#
484 HP Springfield Cross Drum 200#
471 HP Erie City Vert. 200#
451 HP Babcock & Wilcox, 160#
420 HP Sterling, 200#
320 HP Sterling, 200# with Detroit Underfeed Stokers
302 HP Babcock & Wilcox, 200#
300 HP Heine 175#
295 HP (3) Sterling, 200#
253 HP (2) Heine, 160#

TRANSFORMERS

2—678 KVA Maloney 13,800/460 V.
2—500 KVA Maloney 2200/220 V.
Complete Transformer Station; including (3) 333 KVA Transformers 11,000/22,000/33,000—115/230/460 V.
300 KVA, 3 ph. 13,200/6600-220/440 V.
(4) 200 KVA Wghse. 13,200-4000/2300 V.
3—100 KVA G.E. 6600/13,200-230/460 V.
3—100 KVA Al. Chal. 22,000/440 V.
3— 75 KVA Wghse. 11,000/440 V.
3— 75 KVA G.E. 13,200-115/230 V.

GAS & DIESEL UNITS

1000 KVA G.E. 3 ph. 60 cy.; with Cooper Bessemer Nat. Gas. Engine
375 KVA Wghse. 3 ph. 60 cy.; Busch-Sulzer
250 KVA F.M. 3 ph. 60 cy.; Style VA
200 KVA G.E. 3 ph. 60 cy.; Busch Sulzer Diesel.
168 KVA Ideal 3 ph. 60 cy.; Fulton 3 cyl. Diesel Engine; dir. con. exciter

OIL HEATING & PUMPING UNIT

Suitable for 1000 HP to 5000 HP in Boilers

STEAM ENGINES (belted)

20 x 21 Skinner Uniflow; practically new; 150-175 lbs. initial; 15 to 25 lbs. B.P.
TWIN ENGINE, 1200 HP, 2 cyls., 22x32 Nordberg Unif., 160 to 250 lbs., up to 40 lbs. B.P.

STOKERS & PULVERIZERS

Suitable for 250 to 1000 HP.

WE OWN AND OFFER FOR QUICK SALE

THIS EQUIPMENT WAS PURCHASED NEW AND USED ON ONE JOB. IS IN PERFECT CONDITION

10—2500 H.P. General Electric Induction Motors—Type MT-28-2500-257 FORM AE, 3 Phase, 60 Cycle, 6600 Volts, 257 R.P.M. complete with starting equipment.

1—1500 H.P. General Electric, Induction Motor—Type M.T.-28-2500-257 FORM AE, 3 Phase, 60 Cycle, 6600 Volts, complete with starting equipment.

1—700 H.P. General Electric, Induction Motor—completely inclosed. Type M.T.-10-700-720, FORM RE, 60 Cycle, 3 Phase, 6600 Volts, 710 R.P.M., complete with starting equipment.

TRANSFORMERS

3—75 K.V.A.	Single Phase, 60 cycle
15—25 K.V.A.	5940/6600/11430Y to 230
6—15 K.V.A.	Volts

11—Pumps, Hydraulic, Centrifugal, complete 33" Intake, 28" discharge.

6—National Transit Pumps—Horizontal duplex piston, capacity 120 g.p.m. at 415 foothead, size 4½" x 10" and 5¼" x 10", 150 g.p.m. at 185 foothead. All complete with G.E. Motors, 3 Phase, 60 Cycle 220/440 Volts Induction Motors.

3—Winches—Capstan, Silent Hoist, reversible, barrel diameter 10", 12,000 lb. line pull with rope speed at 30 ft. per minute, complete with 20 H.P. Motor, 3 Phase, 60 Cycle, 220 Volts.

13—Winches, Single drum, Chas. C. Steward Machine Co. electric driven, reversing, 15" drum with capacity of 600 ft. of ¾" wire rope, 10,000 lb. pull at rope speed of 25 ft. per minute, max. rope speed 86.6 ft. per minute, minimum rope speed 21½ ft. per minute, complete with 10 H.P. Motor, Induction, 60 Cycle, 3 Phase 220/440 Volts.

8—Travelling Cranes, Curtis Mfg. Co. make minimum span 11' 9⅛", wheel base 6' 6", capacity 20,000 lb., with trolley hoist, Wright, Model BB, hand chain operated.

SAMUEL HUBERMAN

Metropolitan Av. and No. 4th St. **Brooklyn, N. Y.**

REBUILT POWER EQUIPMENT—Ready to Ship

ROTARY CONVERTERS

150 kw., West. 250 v. rpm., 2200 3 ph. 60 cy.

MOTOR GENERATOR SETS

125 kw Crocker Wheeler 250 V. D.C. 1200 rpm., 220/440 v., 3 ph. 60 cy. induction

50 kw. Allis Chalmers 250 V. D.C. 1200 rpm., 220/440 v. 3 ph. 60 cy. synchronous.

ENGINE GENERATOR SETS

50 kw. 250 V. D.C. International P.D.-80 DIESEL ENGINE.

175 kw. West. 2200/2/60 dir. con. Skinner Steam

200 kw. 480 v. 3 ph. 60 cy. direct connected, 300 H.P. Buckeye 4 cylinder vertical Diesel Engine.

225 kw. G.E. 220/440 or 2200 v. 3 ph. 60 cy. dir. con. Ideal Steam

225 kw. Elec. Machy. 2200 or 220 v. 2 ph. 60 cy. dir. con. Ideal Steam

100 HP. LIDGERWOOD HOIST

Double drum Speedwell 2500 lb. pull at 450' per min. direct driven by 100 hp. A.C. or D.C. Motor.

A.C. GENERATORS

219 kva. G.E. 2300/3/60 200 rpm, 80% P.F. (Can be reconnected 440 or 220 v.)

GAS ENGINE GENERATOR SET

75 kw. West. 250 v. belted to 110 HP 2 cyl. Bessemer Gas Engine.

SPECIALS IN SLIPRING MOTORS 3ph. 60 cy.

HP	Make	Speed	Type
1500	Allis Chal.	485	ANY
700	G.E.	393	MT-432
400	West.	1170	CW
300	G.E.	600	M
260	Burke	600	EM-65
250	G.E.	590	I-174
200	West.	690	CW-956A
100	West.	1750	CI

VARIABLE SPEED MOTORS

4—100 HP., Westinghouse SK-190 230 v. D.C. 400/800 rpm.

SYNCHRONOUS MOTORS

225 HP. G.E. 2200 v. 3 ph. 60 cy. 80% P.F. 200 rpm (Can reconnect 440 or 220 v.)

2—150 HP., General Elec. 220/440 v. 3 ph. 60 cy. 200 rpm.

1—100 HP. General Elec. 220/440 v. 3 ph. 60 cy. 200 rpm.

TURBINE

1—Kerr Economy Steam Turbine 450 B.H.P. 3800 rpm. 5" intake, 12" exhaust with Kerr Reduction Unit 3800 to 720 rpm. 115 lbs. pres.

A.C. MOTORS—3 ph. 60 cy.

HP	Volts	Make	Type	Speed
200	2200	G.E.	IK-15	1200
200	220/440	West.	CS	1200
200	220/440	West.	CS	720
200	220/440	West.	CS	600
300	2300	West.	CS	1200
300	2200/440/220	West.	CS	450
350	2200/440/220	West.	CS	450
400	2200/440/220	West.	CS	500
450	2200/440/220	West.	CS	600
500	2200/440/220	West.	CS	720
600	2200/440/220	West.	CS	900

CRANE MOTORS—230 V. D.C.

4—75 HP. G.E. 550 rpm.
1—68 HP. G.E. CO-2007 475 rpm.
1—50 HP. Shaw
1—50 HP. West. K-10, (500 volt) 435 rpm.
1—30 HP. Niles 650 rpm.

SPEED REDUCERS

23—3 to 10 HP Thomas, Ratio 100 to 1; 15 to 1; 10 to 1; 5 to 1.
5—10 HP. 600 At Cleveland ratio 90:1.
1—150 HP. R.D. Nuttal ratio 1.6:1.

TRANSFORMERS

Qua.	Kva.	Primary VOLTS	Secondary VOLTS	Phase
3	1	2200/2080	110/220–120/240	1
5	2	2200/2080	110/220–120/240	1
9	3	2200/2080	110/220–120/240	1
100	5	2200/2080	110/220–120/240	1
6	5	2200/2080	110/220–120/240	1
1	5	2200/2080	110/220–120/240	3
14	7½	2200/2080	110/220–120/240	1
71	10	2200/2080	110/220–120/240	1
10	15	2200/2080	110/220–120/240	1
25	25	2200/2080	110/220–120/240	1
1	30	2200/2080	110/220–120/240	1
1	37	4400	185	1 — Rotary
2	50	2200/2080	110/220–120/240	3
6	50	2200/2080	110/220–120/240	1
2	100	2200/2080	110/220–120/240	1
1	100	440	220	3
3	100	6600/550	440/220	1
3	110	2100	185	1 — Rotary
1	150	2200/2080	110/220–120/240	3
4	400	22000/11000	2300	1

DUQUESNE ELECTRIC & MFG. CO., Pittsburgh, Pa.

MOTORS • GENERATORS • TRANSFORMERS

Prices on Application

3 PHASE—60 CYCLE 220/400 VOLT

H.P.	Make	RPM	Type	Frame
15	Allis-Chalm.	1750	2K54411	
20	Gen. Elec.	1750	KT	753
20	Gen. Elec.	600	I	K
25	Burke	900	EM	
40	Gen. Elec.	900	KT	336
40	Burke	1200	EM	45
40	Westing.	1750	CS	
50	Westing.	900	CS	
50	Gen. Elec.	900	KT	542
60	Burke	900	EM	7
60	Gen. Elec.	1200	I	K
60	Gen. Elec.	1800	I	K
75	Gen. Elec.	1200	KT	343
75	Gen. Elec.	1200	I	K
75	Gen. Elec.	1800	I	K
75	Gen. Elec.	900	I	K
100	Gen. Elec.	1750	I	K
100	Westing.	900	CS	
100	Lincoln	1200		
150	Gen. Elec.	1200	I	
150	Westing.	900	CS	
200	Gen. Elec.	600	I	K
200	Gen. Elec.	720	I	K
200	Gen. Elec.	900	I	K
200	Gen. Elec.	1200	I	K
250	Gen. Elec.	600	I	K
250	Gen. Elec.	720	I	K
250	Allis-Chalm.	900		
300	Gen. Elec.	720	I	K

Compressors in stock up to 300 H.P. Compensators.

ENGINE GENERATOR SETS

1—75 KW General Electric 250 v. DC. Generator direct connected to 100 HP. 14x15 Skinner Uniflow Engine—with panels.

1—50 KW Westinghouse Alternator 3/60/220 volts 277 RPM direct connected to 11x12 Ames Automatic engine —with panels.

AIR COMPRESSORS

1—14"x9"x12" Imperial-Type Ingersoll-Rand two stage 100 lb. pressure belt drive.

1—16"x10"x14" Imperial-Type Ingersoll-Rand two stage 100 lb. pressure belt drive.

DIRECT CONNECTED PUMPS

1—280 G.P.M. Buffalo Pumps, Inc. 30 ft. head direct connected to 3 HP. Westinghouse splash proof motor, 3 phase, 25 cycle, 1450 rpm.

2—400 G.P.M. Buffalo Pumps, Inc. 30 ft. head direct connected to 5 HP. Westinghouse splash proof motor, 3 phase, 25 cycle, 1450 rpm.

3—350 G.P.M. Buffalo Pumps, Inc. 40 ft. head direct connected to 5 HP. Westinghouse splash proof motor, 3 phase, 25 cycle, 1450 rpm.

TRANSFORMERS

Amt.	Kva.	Make	Cycle	Voltage
3	40	G. E.	25	2200/440
3	50	Whse.	25	2200/110/220
3	50	Whse.	25	11000/2200
3	100	Whse.	60	2200/220/440
3	100	Whse.	60	4600/230/460
3	100	G. E.	25	2200/220/440
3	100	G. E.	25	11000/2200
3	200	G. E.	60	2400/220/440
3	200	G. E.	60	4600/230/460
3	200	G. E.	60	6600/220/440
3	500	Pitts.	25	11500/100
3	1000	Pitts.	60	2300/4600/230/460

FREQUENCY CHANGES

94 KVA Westinghouse Synchronous Set Generator, 62½ cy., 230 v., 750 RPM with panels. Motor 112 HP. 3/25/2300/750 Synchronous with starting equipment.

125 KW General Electric Induction 3/220/25 cy. to 3/220/62½ cycle. Motor 100 HP. 25 cy. 750 RPM.

SPECIAL MOTORS

1100 H.P. General Electric Synchronous Motor, 3 ph., 25 cy., 11,500/6600/2200 V., 375 RPM

1—500 H.P. Gen. Elect. Sync. 3/2200/60/1200 R.P.M. with Exciter. New.

500 H.P. Allis-Chalmers, 3 ph., 25 cy., 440 V., 490 R.P.M., Complete.

300 H.P. G.E. Slipring, 25 cy., 3 ph., 2200 V., 500 RPM, 3 bearing; complete with controls.

225 H.P. Electric Mchy. Co. Synchronous, 3 ph., 25 cy., 2200 V., 500 R.P.M. with controls.

1—100 H.P. G.E. Synch. Motors, 3 ph., 25 cy., 220/440 V., with control equipment.

SLIPRING MOTORS

60 CYCLE, 3 PHASE, 220/440 VOLTS

H.P.	Make	Type	Frame	RPM
300	Gen. Elec.	I	Form M	1185
75	Gen. Elec.	MT	537	1800
60	Gen. Elec.	MT	353	1800
60	Gen. Elec. (2)	MT	353	720
50	West.	CW	654C	1800
50	West.	CW	644C	900
50	West.	CW	654C	1800
40	Wagner	22WB		540
40	West.	CW	748	690
40	West.	CW	748	690
40	West.	CW	748	690
30	West.	HP	8B	1745
30	Gen. Elec.	MTC		1725
25	Gen. Elec.	MT	513	1800
25	Gen. Elec.	I	M	1200
25	West.	CW	750C	575
20	West.	CW	648A	575
20	West.	CW	644C	575
20	Gen. Elec.	MT	332	545
20	West.	CW	748A	575
20	West.	CW	748A	575
20	West	CW	748A	575
15	Gen. Elec.	I-M		1725
15	Gen. Elec.	ITC		1735
10	Gen. Elec.	MT		1725

25 CYCLE, 3 PHASE, 440 VOLTS

H.P.	Make	Type	Serial	RPM
150	Gen. Elec.	MT563Y	5056230	725
125	Gen. Elec.	I-17	4550934	360
50	Gen. Elec.	MT547	5264084	720
50	Gen. Elec.	MT353	3879210	750
50	Allis-Chal.		7923K	715
52	Gen. Elec.	ITC5013	1773223	700
40	Gen. Elec.	MT543	4817983	750
40	Gen. Elec.	MT343	3887755	750

25 CYCLE HOIST

1—350 lb. capacity Shaw Box Load Lifter Jr. motor 3/440/25 cycle. 18 ft. lift. 32 ft. per minute.

ERIE ELECTRIC CO., INC.

124 CHURCH ST. BUFFALO, N. Y. CL. 4758

PROMPT SHIPMENT FROM OUR WAREHOUSE

M-G SETS 3 ph. 60 cy. (Syn.)

150 (2) KW Ridg. 275 v. DC—2200 v. AC 900 RPM
150 KW West. 550 v. DC—2200 v. AC—1200 RPM
100 KW West. 275 v. DC—2200 v. AC—1200 RPM
90 KW Al. Ch. 230 v. DC—2200 AC 900
50 KW Al. Ch. 230 v. DC—220/440 AC 1200 RPM

STEAM UNITS

1000 HP West. Mixed Pres. Turbine 3600 RPM 100# or 4#.
100 KW 250 v. DC. Westgh.—Skinner Engine
1—50 KW 125 v. Al. Ch.—Ball Engine.

SYN. MOTORS 3 ph. 60 cy.

HP	Make	Volts	Speed
350	A.C.	2200	600
2-300	G.E. ATI-.88 P.F.	440	1200
225	Ideal (Unity P.F.)	440	900
2-75	G.E.	2200	900
75	Westgh.	220	1800

ELECTRIC FURNACE

3 Ton with 3—333 KVA Transformers 22000 v. 3 ph., 60 cy.

SLIP RING & SQ. CG. MOTORS (3 ph. 60 cy.)

HP	Make	Speed	Wdg.	Type
700	G.E.	393	S.R.	MT432
450	G.E.	257	S.R.	MT
400	G.E.	1800	S.C.	
300 (3)	G.E.	1200	S.C.	
300	G.E.	600	S.R.	I-M
200	Cr. Wh.	440	S.R.	28
200	Al. Ch.	600	S.C.	
125	Al. Ch.	435	S.R.	
125	Burke	1200	S.C.	
100	G.E. 25 cy.	500	S.R.	MI-108
100	Burke	900	S.C.	
100	Lincoln	1200	S.C.	
100	F. M.	600	S.C.	BB
75	West.	575	S.R.	CW868A

DC VARIABLE MOTORS (230 VOLTS)

HP	Type	Make	Speed
75	SK	Westgh.	475/1425
20	SK	Westgh.	900/1800
10	SK	Westgh.	600/1200
5	SK	Westgh.	450/1800
2	SK	Westgh.	500/1800

AC GENERATOR

219 KVA G.E. TRE 2400/480/240 v. 3 ph. 60 cy. 200 RPM with exc.
200 KVA G.E. Type ATB 2200/440/220, 720 RPM, 3 brg.

AIR COMPRESSORS

2200 cu. ft. 100# Chic. Pneu. Steam #9198.
550 cu. ft. 100# Bury 2 stage
160 cu. ft. Chic. Pneu. 160#
67 cu. ft. Ing. Rand ER 1 100#

SHOP HOISTS.

2—2 Ton Yale & Towne A.C. 220/3/60
7—2 Ton Sprague 230 v. or 500 v. D.C. Mono-rail.
2—4 Ton Sprague 230 v. or 500 v. D.C. Mono-rail.

5—75 HP 230 v. Generator Electric Type 211 series wound with interpoles 550 RPM.

6—500 HP Type CS 2200 v. 3 ph. 60 cy. 500 RPM Westinghouse 3 brg.
5—350 HP Same as above.

OIL ENGINE DRIVEN AIR COMPRESSOR

Chicago Pneumatic simplate-valve Type NS03 straight line 16½" & 11" x 18" cap. 492 cu. ft. 100# pres. with air receiver and starting air compressor.

In addition to the Above We have Hundreds of Other Items in Stock—Kindly Send Us Your Inquiries

MOORHEAD-REITMEYER CO., INC., Pittsburgh, Pennsylvania

IF YOU DON'T KNOW MACHINERY—KNOW YOUR MACHINERY DEALER

TURBO GENERATORS

1—937 KVA, 750 KW, 3 ph., 60 cy., 2300 V., 3600 rpm Gen. Elec. complete with C. H. Wheeler surface condenser pumps, radiojet.
1—625 KVA, 500 KW, 3 ph., 60 cy., 480 V., 3600 rpm, Gen. Elec. with direct connected exciter.
1—same in 2300 volts.

GAS ENGINE UNIT

1—140 KVA, 98 KW, .7 P.F., 60 cy., 277 rpm, Gen. Elec. with direct connected exciter to 4 cylinder Foos engine. Has gasoline attachment.

The above are just a few of the thousands of items we have in Motors, Generators, Turbo Generators, Engine Generators, Motor Generators, Transformers, Circuit Breakers, etc. Please send us your inquiries. What have you for sale?

George Sachsenmaier Co.

8403 Hegerman St. Phila., Pa.

—TRANSFORMERS—

TRANSFORMERS WANTED

in operating condition or burnt out. Mail us list giving complete nameplate data and stating condition.

We Rewind, Repair and Redesign all Makes and Sizes
ALL TRANSFORMERS GUARANTEED FOR ONE YEAR
Write for Catalog No. 136-F

THE ELECTRIC SERVICE CO., INC.

"AMERICA'S USED TRANSFORMER CLEARING HOUSE"
STATION M Since 1912 CINCINNATI, OHIO

Motor Generator Sets—Synchronous Motors, etc.

MOTOR GENERATOR SETS
3 phase, 60 cycle, A.C.

250 KW G.E. Rotary 275 Volt D.C. 2300 Volt A.C.
100 KW West. Rotary 275 Volt D.C. 2300 Volt A.C.
1—75 KW West. M.G. Set 250 V. D.C. 440 V. A.C.
50 KW Allis-Chalmers 250 V. D.C. 2200 V. A.C.

SYNCHRONOUS MOTORS
3 phase, 60 cycle

2—G.E. 700 HP 720 RPM 6600/4000/2300 Volt
Burke 300 HP 900 RPM 440/220 Volt
Ridgway 150 HP 1200 RPM 2300/440 Volt
C.W. 100 HP 900 RPM 440/220 Volt
Fairbanks-Morse 75 HP 720 RPM 220 Volt
G.E. 60 HP 720 RPM 440/220 Volt

SLIP RING MOTORS 3 phase 60 cycle

G.E. 60 HP 720 RPM 440/220 Volt
Allis-Chalm. 250 HP 600 RPM 440/220 Volt

ADJUSTABLE SPEED
220 Volt D.C. Motors

1—West. SK-201 150 HP 350/900 RPM
1—G.E. RF-18 90/120 HP 400/1200 RPM
1—G.E. RF-17 50/100 HP 450/1200 RPM
1—Reliance 1400-T 100/125 HP 300/900 RPM
1—West. SK-180, 100 HP 600/950 RPM
1—West. SK-180 45/90 HP 475/950 RPM
1—Diehl 60 HP 500/1500 RPM
1—Reliance 1400-T 50 HP 175/700 RPM
1—Reliance 461-T 50 HP 600/1400 RPM
2—Crocker-Wheeler 125-H 50 HP 175/700 RPM
1—Allis-Chalm. 35/70 HP 450/1350 RPM
1—Allis-Chalm. 25 HP 600/1800 RPM
2—West. SK-123 5 HP 300/1200 RPM enclosed

The Electric Motor & Repair Co., Cuyahoga Falls, O.

SYNCHRONOUS CONVERTERS

500 KW West. 250 D.C. 2300/4000 A.C. 1200 RPM
300 KW G.E. 600 D.C. 2300/4000 A.C. 1200 RPM
200 KW Al-Ch, 250 D.C. 2300/4000 A.C. 1200 RPM
150 KW R.W. 250 D.C. 2300/4000 A.C. 1200 RPM

SYNCH. MOTOR GENERATORS

200 KW G.E. 250 V. 2300/4000 A.C. 1200 RPM
200 KW G.E. 250 V. 2300 A.C. 720 RPM
150 KW R.W. 250 V. 2300 A.C. 900 RPM
100 KW WEST. 250 V. 2300 A.C. 900 RPM

IND. MOTOR GENERATORS

300 KW G.E. 250 V. 440 A.C. 720 RPM
200 KW G.E. 250 V. 440 A.C. 720 RPM

Each unit listed above is owned by us and is Available now for immediate purchase.

WALLACE E. KIRK CO.

Incorporated

502 Grant Building Pittsburgh, Pa.

TRY US WHEN BUYING OR SELLING

1000 KW 175 lb. 440 volt Turbo Generator.
250 KVA Chuse 3/60/2300 V. Engine Generator.
100 KW Skinner Uniflow, 3/60/2300 volt.
125 HP, 250 lb. Firebox Type Boiler.
150 HP Fairbanks Morse "Y" Oil Engine.
180 HP Fairbanks Morse "VA" Diesel Engine.
60 HP Muncie Horizontal Oil Engine.
75 KVA 3/60/2300 V. 257 rpm Rotor & Stator.
24 ton Link Belt Electric Locomotive Crane.
50 ton Baldwin 6 wheel Saddle Tank Switcher.
3—400 HP 150 lb. Heine ASME Boilers with or without 2—500 KVA 3/60/2300 V. Turbines.

Mississippi Valley Equipment Co.

507 Locust St. St. Louis, Mo.

ENGINE GENERATOR SETS

1—312 KVA West. 3/60/2300 v. belt, exct. dir. con. Murray Special Corliss left hand eng. 18x30.

AIR COMPRESSORS

1—610 c. ft. I.R. St. Dr. 100# air, 150# stm.

SURFACE CONDENSERS

2—10 AD 4 pass 210 ft. Foster Wheeler over Comb. Air Circulating and Tail pump.

STEAM PUMPING ENGINES

1—Snow 6 mgd C&FW Cr. Com. Opp. Type Cond. 20-40x14¾x36, with waterwork type cond.
1—Allis-Chal. 4 mgd. cr. com. cond. Size 12x28x13x24. Fine cond.

PUMPS

Worth Dup. Pump size 16x12x12, cap. 1100 gpm. heavy water wks. type.

BIRCH MANUFACTURING COMPANY

1523 Sedgwick St. Chicago, Ill.

TRANSFORMERS

A new Lot of Reconditioned Transformers acquired—200KVA and down. Let us have your inquiries.

Electric Apparatus Repair Co.

Specialists on Rebuilding Motors, Generators and Controls

1410 No. 6th St., PHILA., PA.

180 H.P. Worthington Diesel Engine Generator Set Solid injection, 3 Cyl., 2 Cy., 327 R.P.M., 12½ x 13¾. Direct Conn. to 100 K.V.A., 3 Ph., 60 Cy., 240 V. Type ATI, .8 P.F. GE Gen., Gen. #4703807. Belted to 6 K.W. G.E. Exciter, Type CD, 125 Volts. Complete with switchboard, exhaust muffler Griscom-Russell Multi-Whirl Cooler. Also, Power take-off, clutch and pulley formerly used to drive 60 Ton Ice Machine.

ALJON ELECTRIC DIESEL CO.
151-5 Washington St., Main 4-3804-5. Bklyn, N. Y.

SEARCHLIGHT SECTION

SLIP RING MOTORS, 3 PH., 60-CY.

HP	Volts	Make	Speed
500	2300	Whse.	450
350	2200	G.E.	600
300	2300–4000	G.E.	1200
250	440–550	G.E.	600
200	2200–550	G.E.	1800
200	2200–440	G.E.	600
150	440–220	G.E.	1800
150	2200	G.E.	900
150	2200–440	Whse.	1800
150	550–2200	G.E.	1800
100	550–2200	G.E.	720
100	220–440	G.E.	720
100	440–220	G.E.	600
100	220–440	G.E.	900
80	220–440	G.E.-MTC	900
75	440–220	G.E.	900
75	220–440	G.E.	600

SYNCHRONOUS MOTORS, 3-PH., 60-CY.

400	440–220	Whse.	276
350	440–220	G.E.	200
250	2300	G.E.	900
240	2300–440–220	G.E.	600
200	2300–4000	G.E.	1200
150	2200	G.E.	1800
100	440–220	G.E.	1200
50	220–440	G.E.	1200

TRANSFORMERS—60 CYCLE

3—400 kva., G.E. type H, 13200-440.
3—250 kva., G.E. type H-KD 23000-2300.
3—200 kva., G.E., H-KD 6600-2300/4000Y., 25 cy.
1—100 kva., Pittsburgh, type OISC 2400-240-120.
3—200 kva., G.E., type H-KD, 13800-230/460.
2—150 kva., Whse. 4800/4156/2400-480/240.
3—100 kva., G.E. type H, 2300-230/115.
3—100 kva., Whse type, SK, 2300-230/115.
3—100 kva., G.E., type H-KDD, 6900/11950Y-230/115.
3— 75 kva., G.E., type HK, 2300-230/115.
3— 50 kva., Pittsburgh, 13800-240/120.
3— 50 kva., Moloney, 2300-230/115.
6— 50 kva., Whse type SK, 13800-240/120.
3—37½ kva., G.E., type H-K 2200-460.
3—37½ kva., G.E., type H-K, 2300-230/115.
3— 25 kva., G.E., type H-K 2300-230/460.
3— 25 kva., Whse type S 2300-575.
3— 25 kva., G.E., type H-KR, 6900-230/460.

A. C. GENERATORS

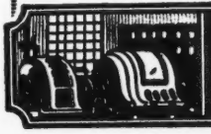
1—500 KVA, 900 r.p.m. 2209 V. Whse. Condenser.
1—312 kva., 900 r.p.m., 2300-V., Westghse.
1—300 kva., 600 r.p.m., 240-480-V., G.E.
1—225 kva., 600 r.p.m., 2200-240-480-V., G.E.
1—219 KVA, 200 r.p.m., 480 V. Whse.
1—187 kva., 900 r.p.m., 2200-550-V., Westghse.

SQUIRREL CAGE MOTORS

HP	Volts	Make	Type	Speed
500	440/220	G.E.	IK	1200
500	440/220	G.E.	IK	900
400	2200	Whse.	C.S.	1800
300	2300/440	G.E.	IE-K	1200
250	2200	G.E.	IE-K	1800
250	2200	G.E.	I-K	600
200	220/440	G.E.	IK	720
200	2200	G.E.	IK	720
150	2200	Allis Ch.	AN	450
100	2200	G.E.	IK	600
100	2200	G.E.	IE-K	1800
100	550	G.E.	KT	900
100	220/440	G.E.	KT	720
75	2200	G.E.	KT	900
75	2300	G.E.	IE-K	1800
50	220/440	G.E.	K	1800

MOTOR GENERATOR SETS

1—100 K.W., 250 V., 1200 R.P.M. Ridgeway, con. to 150 H.P., 2200 V., 3 ph., 60 cy., syn. motor.
1—60 K.W., 125 V., 1200 R.P.M. GE. type RC to 90 H.P., 4150/2300 V., 3 ph., 60 cy. syn.
1—25 K.W., 125 V., 1800 R.P.M., G.E., con. to KT 40 H.P., 2200/440 V., 3 ph., 60 cy. motor
1—GE, 3 unit set, consisting of 1 type RC, 10 KW, 250 V., 1750 RPM, and 1 RC, 10 KW, 125 V. Generators, coupled to KT, 35 H.P., 220/440 V., 3 ph., 60 cy., SC motor.



STEPHEN HALL & COMPANY, INC.

458 Seventh St., Hoboken, N.J.

POWER PLANT EQUIPMENT

TURBO-GENERATORS

1—1200 KW Allis 600 V. Cond.
1—2500 KW. G.E. 2300 V. Cond.
1— 625 KW Terry-Allis—600 V. Cond.
1— 500 KW. G.E. 2300 V. Mixed P.
1— 500 KW. G.E. 600 V. Cond.
1—175 H.P. G.E. Turbine—only.

AIR COMPRESSORS

1—2700 Cu. Ft.—IR—2300 V. Syn. Motor.
1—2588 Cu. Ft.—IR—Steam Driven. Cond.
1—782 Cu. Ft.—IR—55#.
1—888 Cu. Ft.—IR—2 stage Steam.
1—599 Cu. Ft.—IR—2 stage Belted
2—549 Cu. Ft.—IR—Duplex 35# pressure.
1—173 Cu. Ft.—IR—ERI Belted.
1—146 Cu. Ft.—IR—3 stage Belted 2000#

G.E. CENTRIFUGAL COMPRESSOR

Type WM—675—8800/10800.
Volume—8800/10800 Pressure 32/39.6.
Driven by 820 H.P. G.E. Turbine.
Condition excellent.

BOILERS

1—340 H.P. B&W Sterling—150#
2—160 H.P. B&W Sterling—155#
1—167 H.P. HRT—150#
1— 60 H.P. HRT—125#

WATER WHEEL GENERATORS

1—240 KW. 2300 V. connected to 360 H.P. Type Z wheel 13-15 Hd.
1—312 KVA. 2400 V. connected to Rodney Hunt wheel 17' Hd.
1—625 KVA. Morgan Smith 42' Hd.

BELTED GENERATOR

1—500 KW. G.E. 550 V. 225—RPM.

PUMPS

1—1500 GPM, Gould Fire Pump, 231 Ft. Head
Driven by 150 H.P. G.E., 2200 V. motor

MOTORS

14—Motors, 25 cycle, 440-550 volts.
H.P. ranging from 15 to 350.

Also transformers, engines and cranes

Send us your inquiries

A. LEE ELLIS CO., U. S. Mchy. Bldg., Boston, Mass.

The Buyer Must Be Satisfied—Always

Immediate Shipment!

1—200 KW **Westg. Syn. Motor Generator Set,** 600 V. D.C., Gen., connected to 290 H.P. Synch. motor 3/60/2200 and 900 RPM, with exciters and controls

1—1000 KW **Turbine type Generator,** 3/60/2300 3600 RPM, Type ATB 2

5—50 H.P. **G.E. Unused** Slip Ring Type MTC **Hoist and Crane Motors,** 600 RPM, 3/60/440.

5—50 H.P. NEW **Allen-Bradley Reversing Type Controllers,** self-contained, 3/60/440 V.

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1—450 H.P., 250#, bent tube, under feed stoker.
Sectional header boilers, (3) 300 H.P., (1) 175 H.P., 200% rating, (2) Battery of Suspended H.R.T. boilers, 268 H.P. (each).
B&W Superheater, (used 9 months) suitable 500 H.P. boiler—100 degree.
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IMMEDIATE DELIVERY — NOW IN STOCK

3—825-HP, B & W, Stirling Type, 4-Drum, 200# WP, ASME Code, Westinghouse Underfeed Stokers.

6—400-HP, B & W, Straight Tube, Sectional Steel Headers, 200# WP, ASME Code, Superheaters, Oil Fired.

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1—3500 KW, G.E. Synchronous Booster type 250/310 volts D.C. with a 3800 KVA, 6600/10,900/12000 volts 3 phase, rotary converter type transformer and accessories, now skidded for immediate delivery.

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1—3000 1—500 KW West. Condensing 2300 V. & 440 V.

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5—604 HP Babcock & Wilcox 200 lbs. working pressure.

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2 Direct connected Engine Driven DC Generators

1—110-120 Volt Bullock DC Generator 520 amps. 275 RPM direct connected to Erie Slide valve engine.

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Both in good running order.

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100 HP. 490 RPM. 3/60/440, Westhouse sqrl. cage
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15 KW. 1800 RPM. 3/60/220-440, Gen. Elec. TAB
60 KW. 1200 RPM. 3/60/220-440, Gen. Elec. ATB
75 KVA. 1200 RPM. 3/60/2300 v. Gen. Elec. ATB

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42 KVA. 3/60/240 volt, Gen. Elec. TRE gen. dir. con. 60 HP. Brownell slide valve steam engine

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75 KW. 125 volt DC Ideal 3/60/440 v. AC motor

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1200 Amp. 6 volt, 1200 RPM. Meaker generator

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450 H.P. Bessemer Solid injection Full Diesel Engine, 225 R.P.M., 4 Cylinder, 4 Cycle, 15" Bore x 22" Stroke, Tex Rope Drive to 300 K.W. G.E. Generator, 3 Phase, 60 Cycle, 2300 volt with Switchboard and G.E. Tyrell Voltage Regulator.

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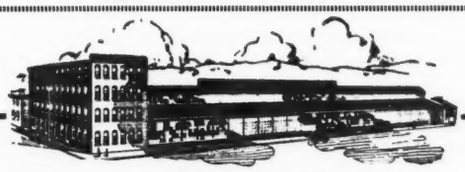

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220 V. 3 Ph., 60 Cycle

1—40 HP, 1200 RPM, Type 19TRN
2—100 HP, 1200 RPM, Type 26V

440 V. 3 Ph. 60 Cycle

1—7½ HP, 1200 RPM, Type 13TRN
1—50 HP, 600 RPM, Type 26TRN
1—50 HP, 1200 RPM, Type 19VRN
1—125 HP, 720 RPM, Type 31V
3—150 HP, 900 RPM, Type 31V

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3—500 KW General Electric, 600 volts, D.C., direct connected to 700 HP, 720 RPM, 2500/5000 volts, 3 phase, 60 cycle Synchronous Motor with direct connected exciters.

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1—125 KW, 125 volt, 250 RPM, Westinghouse Generator connected to a 15" x 16" Skinner Automatic Engine.

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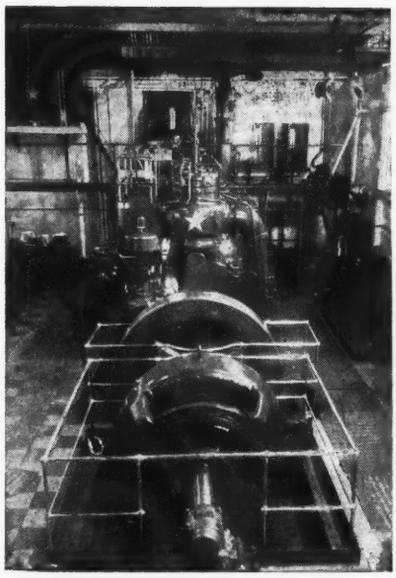

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Re-built Motors and Generators

2—75 HP, 2200 V, **Fairbanks Morse,** 1800 RPM, 3 PH, 60 CY slip ring motor, direct connected to 500 GPM 3 stage 300' head pump.

1—400 HP **Westinghouse,** type CW, 3 PH, 60 CY, 440 V, 450 RPM slip ring motor.

3—350 HP **Allis Chalmers,** 3 PH, 60 CY 440 V, 600 RPM slip ring.

1—300 HP **Allis Chalmers,** 3 PH, 25 CY, 440 V, 485 RPM slip ring.

2—250 HP **Westinghouse,** type CS1012, 3 PH, 60 CY, 440 V, 435 RPM sq. cage.

1—200 HP **Westinghouse** syn. 1 PF, 3 PH, 60 CY, 2200 V. 600 RPM with direct connected exciter, 3 or 2 bearing.

2—150 HP **Allis Chalmers,** 3 PH, 60 CY, 440 V, 450 RPM slip ring.

2—150 HP **Westinghouse,** type CW, frame 1000, 2 PH, 60 CY, 440 V, 450 RPM slip ring.

2—100 HP **Westinghouse,** type CS, frame 754 C, 3 PH, 60 CY, 440 V, 870 RPM sq. cage.

3—150 HP **Allis Chalmers,** 3 PH, 60 CY, 440 V, 1750 RPM sq. cage.

1—100 HP **Westinghouse,** type CCL, 3 PH, 60 CY, 2200 V, 1750 RPM sq. cage.

1—100 HP **Wagner,** type 26V5BP, 3 PH, 60 CY, 440 V, 860 RPM sq. cage

2—100 HP **Allis Chalmers,** type ANY, 3 PH, 60 CY, 440 V, 690 RPM slip ring.

1—100 HP **Westinghouse,** type SK, frame 160, 230 V, 1100 RPM.

1—100 HP **Allis Chalmers,** type ANY, 3 PH, 60 CY, 2200 V, 690 RPM slip ring.

1—75 HP **Allis Chalmers,** 3 PH, 60 CY, 440 V, 450 RPM slip ring.

1—75 HP **Westinghouse,** type CW, 3 PH, 60 CY, 440 V, 720 RPM slip ring, 3 or 2 bearing.

1—75 HP **Fairbanks Morse,** type H, frame 165 C, 3 PH, 60 CY, 550 V, 900 RPM sq. cage.

2—75 HP, **General Electric,** type I, 3 PH, 60 CY, 220 V, 720 RPM sq. cage.

1—75 HP, **General Electric,** type MT, frame 337, 220 V, 3-60-1745 RPM.

1—75 HP **Lincoln,** type IQ, 2 PH, 60 CY, 440 V, 600 RPM sq. cage.

1—75 HP **Finn-Weiksel (Wagner)** ty. 26VRN, 3 PH, 60 CY, 220 V, 1200 RPM syn.

1—250 HP **Crocker Wheeler,** type CCM, size 151 H, 230 V, 600 RPM, DC

3—100 HP **General Electric,** type CD, frame 123, 230 V, 1200 RPM DC

1—60 HP **General Electric,** type CD, frame 115, 230 V, 850 RPM, DC

1—50 HP **Westinghouse,** type SK, frame 160, 230 V, DC, 565 RPM

1—50 HP **General Electric,** Class 6, Form B, 600 V, DC, 600 RPM

1—50 HP **Ideal,** type SMS, 3 PH, 60 CY, 220 V, 1800 RPM, synchronous.

1—60 HP **Westinghouse,** type SK, frame 160, 230 V, DC, 680 RPM

1—60 HP **C&C,** 230 V, DC, 250/1000 RPM

1—75 HP **General Electric,** type CD, frame 176, 550 V, DC, 250/1000 RPM

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207 N. Fourth St. Hamilton, Ohio

Est. 1903

1—380 HP **Heine boilers**, 180# pressure.
3—512 HP **Stirling**, Class S-26 200# pressure.
1—451 HP, 160# pressure, **B.&W.** sectional header.
1—600 HP **B&W boilers**, 200# pres.
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1—15 Ton 55 span three motor **AC Crane**, overhauled.
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1—2000 KW **Westinghouse condensing turbine**, complete.
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1—250 KVA **Erie Ball Corliss** engine generator.
2—312 KVA **Skinner uniflow engine.**

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1—250 KVA **Fairbanks Morse full Diesel engine.**
1—300 KVA **Fairbanks Morse VA full diesel engine generator sets.**
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5—180 HP **Fairbanks-Morse** Model 35, Oil Engines, new in 1935.
1—84" x 125' self-supporting steel stack.
1—3500 HP **Swartwort open feedwater heater.**

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30" Pipe Fittings, and 60" Valve. Mtr. Dr.
36000 GPM. 27' Head Cent. Pump
100 To 550 HP Gasolene Engs. New, Used.
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250 HP. Motor drive 440 V 60 cy 3 ph.
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With (3) 450 HP Heine boilers recently passed for 160# pressure—Steel building with bunkers, coal handling equipment, stokers, etc.
3—133 HP B&W Stirling Boilers
5—250 HP B&W Stirling Boilers
ALSO PUMPS, COMPRESSORS, MOTOR GENERATOR SETS, ETC.

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125 KVA G.E. AC Gen. driven by 6 cyl gas or nat. gas engine
NEVER USED—NEW—
200 KW—315 v. Gen. 1150 RPM DC motor: 300 HP 230 v. DC Crocker Wheeler Booster Set equal to new
A LARGE SELECTION OF UNUSUAL ITEMS

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2—MOLONEY TRANSFORMERS 500 K.V.A. High Voltage 2300. Low 115–230. Polarity Subtractive — 60 cycle single phase
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SWITCHBOARD and circuit breakers with generator sets.

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250 KVA **General Electric** 3 phase, 60 cycle, 220 volt **alternator**, direct connected 17 x 20 Erie Ball 4 valve Engine, 200 RPM, with switchboard
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One Republic Steam Flow-Meter for high pressure.

F S 274 Power
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FOR SALE

One—**600 KW Allis-Chalmers High Pressure Condensing Steam Turbo Generator**, 3 phase, 60 cycle, 600 volts, 3600 RPM.
One—**500 KW Allis-Chalmers Low Pressure Condensing Steam Turbo Generator**, 3 phase, 60 cycles, 480 volts, 3600 RPM, with double inlet surface condenser.
One—**400 KW Geared Westinghouse 150 Pressure Condensing Steam Turbo Generator**, 3 phase, 60 cycles, 4000/2300 volts.
The above units are in good operating order, ready for shipment.

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600 KW. in 2 units, 400 RPM. NEW.
350 KW. in 2 units, 257 RPM. A-1
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200 KW. 125 v. DC. Eng. Generator 125 RPM
20"x42" Heavy duty Corliss Engine

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Oil, Gas & Steam Engines—Compressors—Generators

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25000 gal. Cap. Steel water storage Tank on 68' Steel Tower

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Capacity 600 GPM, 30 ft. head, driven by 3 Terry Type Z-1 turbines good for maximum of 250#.

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2—Pass—Cylindrical Shells
1—8,000 sq. ft. cooling surface
1—12,000 sq. ft. cooling surface
Both with complete accessories

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1—280 H.P. **De La Vergne**, Horiz., 2-Cylinder 20" x 34 Full Diesel Solid Injection, Direct Connected to 240 Kva G-E Generator 3/60/2300 V.
Both have Exciters, and Switch Boards
All Ready for shipment—Kansas City.
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Ridgway Steam Engine, 500 H.P., Single Cylinder, 4 Valve.
Direct Current Generator, 300 K.W., 125/250 Volts.
Serviceable operating condition.
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1—75 KW 120 volts DC Western Electric Generator, 275 RPM direct, connected to counterflow engine.

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1—60 HP., G.E. Co., Type CD, 1750 RPM.
1—50 HP., G.E. Co., Type RLC, 900/900 RPM.
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150 KW MOTOR GENERATOR SETS

2—150 KW Gen. Electric Synch. Motor Generator Sets 500 volts D.C., 3-60-2300 volts A.C. with swbds.

FREQUENCY CHANGERS — TURBO GENERATORS — AC & DC MANUAL MAGNETIC CONTROL — CENTRIFUGAL PUMPS — AC & DC SWITCHBOARDS

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Available Missouri now, used 2 years.

2—360 HP Heine 175# pressure boilers.
2—500 k.w. turbines condensing or non-condensing, forced draft chain grate stokers, stacks, etc.

ALSO

1000 HP, 275# Stirling boiler.
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100,000—50,000 steel tanks on 100' tower.
50 HP vertical construction boilers.

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ALL REBUILT AND GUARANTEED

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1—Atlas Imperial power unit 90 HP 700 RPM 6 cyl. 4 cycle. Enclosed flywheel and water pump. Cast iron legs for flat mounting.
1—Chicago Pneumatic 160 HP 4 cyl 4 cycle 327 RPM heavy duty full diesel engine with extended shaft and outboard bearing with clutch pulley.

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1—300 HP Ridgway 4-valve steam engine d/c to 1—250 KVA 3/60/2300 Ridgway A.C. Generator. Complete with exciter and switchboard.

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1—312 KVA Gen. Elect. 3/60/2300 3-bearing machine with 36" paper pulley. All mounted on cast iron sub-base. A Bargain.

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3—333 KVA Transformers—G. E. Outdoor type 22000 V. pri. 11000 sec. Excellent cond. on original foundations.
500—KW Turbo-Generator dir. conn. to G. E. 625 KVA-AC-60 cyl.-3 ph.-2300 V. gener. comp. and in fine condition—reasonable.
1800—HP United Eng. & Fdy. Mill Drive gear reduction unit — Excellent cond. — attractive price.

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1—75 HP HRT boiler 125 lbs. WP 54" drum, 16' long with 52 3½" tubes.

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3—Westinghouse 667 KVA Transformers. 13,800—440 v.
2—15-ton Hand operated Traveling Cranes. 100 foot runways.
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QUICK QUIZ

FOR POWER ENGINEERS

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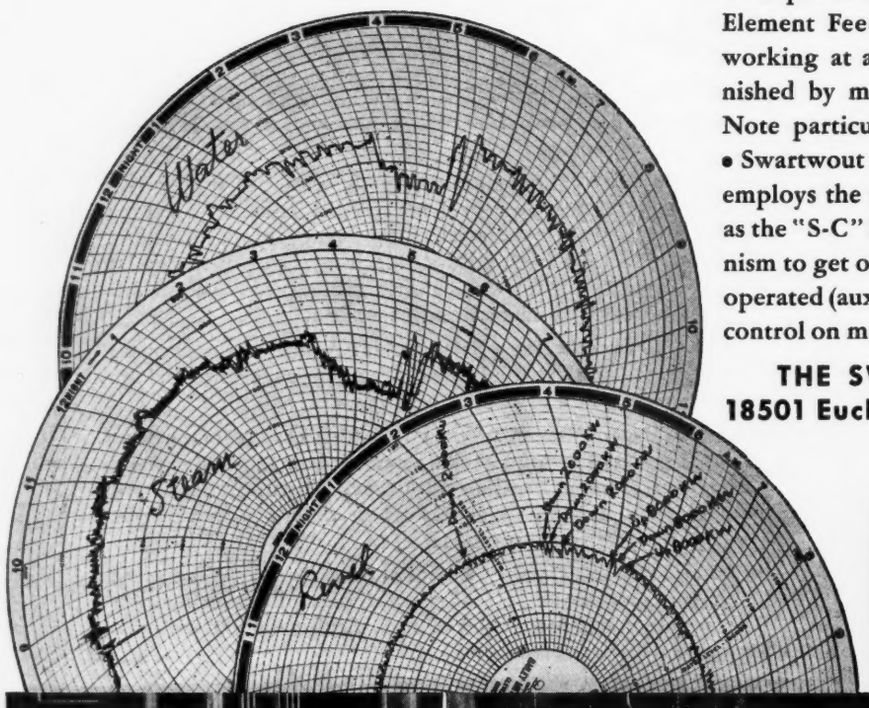

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